SOUTH KENSINGTON MUSEUM ART HANDBOOKS.

EDITED BY WILLIAM MASKELL.

GLASS.

These Handbooks are reprints of the dissertations prefixed to the large catalogues of the chief divisions of works of art in the Museum at South Kensington; arranged and so far abridged as to bring each into a portable shape. The Lords of the Committee of Council on Education having determined on the publication of them, the editor trusts that they will meet the purpose intended; namely, to be useful, not alone for the collections at South Kensington but for other collections, by enabling the public at a trifling cost to understand something of the history and character of the subjects treated of.

The authorities referred to in each book are given in the large catalogues: where will also be found detailed descriptions of the very numerous examples in the South Kensington Museum.

W. M.

December, 1878.

LAMP FOR A MOSQUE.

Arabian, 14th Century. (1056-'69.)

GLASS

BY

ALEXANDER NESBITT, F.S.A.

WITH NUMEROUS WOODCUTS.

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CONTENTS.

CHAPTER VII.

CHAPTER VIII.

CHAPTER IX.

LIST OF WOODCUTS.

LIST OF CHROMOLITHOGRAPHS,

INSERTED IN FIFTY COPIES ON LARGE PAPER.

GLASS.

CHAPTER I.

On the Composition of Glass.

Glass is a substance of which the principal and essential constituents are silica and an alkali. It may be considered as consisting of one or more salts, which are silicates with bases of potash, soda, lime, oxide of iron, aluminium, or lead—in any of which compounds one of these bases may be substituted for another, provided that one alkaline base be left. Sometimes glass is defined as an amorphous silicate, because, if re-heated and kept long at a high temperature below the fusing-point, it passes from the vitreous to the crystalline state, and is then said to be devitrified.

Glass may be divided into two classes, native and artificial. The first, known as obsidian, is found in the vicinity of volcanoes and is an impure semi-transparent glass, varying in colour from grey to black. This was used in the fabrication of works of art by the Egyptians and Romans, and in later times by the Mexicans. The other class, viz., that produced artificially, has been of infinitely greater importance to mankind; for, though the arts of metallurgy and of pottery ministered more directly to the needs of man in the earlier stages of his existence on the earth, that of glass making conduces to his progress in knowledge and art, to his comfort, and to his luxury in a most remarkable degree.

We owe to artificial glass not only our knowledge of the distant

heavens and of the minute structure of all around us, but the inestimable advantage also of abundant light in our dwellings and workshops, the plenty of cheap, cleanly, and elegant vessels for so many of our domestic needs, and the frequent gratification of our taste for the beautiful; for glass presents itself to our eyes on all sides, not only in windows, mirrors, and vessels formed entirely of glass, but as enamel and glaze on the surfaces of metal and pottery. We remember how Dr. Johnson, in one of the papers of "The Rambler," expresses himself when considering from what unpromising beginnings the most useful productions of art have arisen: "Who," he says, "when he first saw the sand and ashes by casual intenseness of heat melted into a metalline form, rugged with excrescences and clouded with impurities, would have imagined that in this shapeless lump lay concealed so many conveniences of life as would in time constitute a great part of the happiness of the world? Yet by some such fortuitous liquefaction was mankind taught to procure a body at once in a high degree solid and transparent, which might admit the light of the sun and exclude the violence of the wind, which might extend the sight of the philosopher to new ranges of existence, and charm him at one time with the unbounded extent of the material creation, and at another with the endless subordination of animal life, and, what is yet of more importance, might supply the decay of nature and succour old age with subsidiary sight. Thus was the first artificer of glass employed, though without his own knowledge or expectation. He was facilitating and prolonging the enjoyments of light, enlarging the avenues of science, and conferring the highest and most lasting pleasures; he was enabling the student to contemplate nature, and the beauty to behold herself."

Its adaptability for all these uses is owing to certain peculiarities: glass is tenacious when softened by heat, and capable when in that state of being moulded into any desired form; it retains on cooling the smooth and shining surface which it acquires on being heated, so that no costly polishing processes are required; and it can be

produced either wholly devoid of colour or tinted with any hue, and either opaque or transparent, without loss of brilliancy. These qualities have made vessels and ornaments of glass to be wished for and admired both by the savage and by the man of the most refined taste; they have given us in the painted windows of the mediæval churches objects of almost unearthly splendour, and in mosiac the noblest and most lasting means of internal decoration.

Although it is not the object of this handbook to enter into the subject of the manufacture of glass, it is necessary that a few words should be said as to its chemical composition.

The following classification of glasses, founded on their chemical composition, has been proposed (Ure's "Dict. of Arts, &c., Art. Glass"):—

1. Soluble glass: a simple silicate of potash or soda, or of both these alkalies.
2. Crown glass: a silicate of potash and lime.
3. Bottle glass: silicate of lime, soda, alumina, and iron.
4. Common window glass: silicate of soda and lime, sometimes also of potash.
5. Plate glass: silica, soda or potash, lime, and alumina.
6. Ordinary crystal glass: silicate of potash and lead.
7. Flint glass: silicate of potash and lead.
8. Strass: silicate of potash and lead, still richer in lead.
9. Enamel: silicate and stannate, or antimoniate of potash, or soda and lead.

We must remember with regard to this table that crown glass always contains soda, that alumina and iron are accidental not essential constituents of bottle glass, and that enamels vary very much in their composition; tin is not present in transparent enamels.

The proportions in which these are combined, so as to form the various kinds of glass, are about as follows:

	Silicic Acid.	Potash or Soda.	Lime.	Ox. of Lead or Iron.	Alumina.	Water.
Soluble glass	62	26	—	—	—	12
Crown ,, ...	63	22	12	—	3	—
Bottle ,, ...	54	5	20	6 ox. iron	—	—
Common window glass	69	11 soda	13	—	7	—
Plate glass	72	17 ,,	6	2 ox. iron	2	—
Crystal ,, ...	61	6	—	33 lead	—	—
Flint ,, ...	45	12 potash	—	43 ,,	—	—
Strass ,, ...	38	8	—	53 ,,	1	—
Enamel ,, ...	31	8	—	50 ,,	10 ox. tin	—

An analysis of plates of glass found at Herculaneum gives the composition as: silica, 69; soda, 17; lime, 7; alumina, 3; oxide (of iron?), 1.

Analyses of ancient Roman glass show the following results:

	Silica.	Alumina.	Ox. of Iron.	Manganese.	Lime.	Magnesia.	Soda.
Roman base (?)	70·58	1·80	·53	·48	8	trace	18·86
,, flattened glass...	71·95	trace	3·45	·57	7·33	·60	15·30
,, lachrymatory ...	71·45	2·15	1·02	·17	8·14	trace	16·62

from which it appears that its composition did not differ very much from that of plate glass.

Venetian glass, like Roman, was made principally with soda; but it appears from the receipts given in some 15th century manuscripts which have been recently printed, that a mixture of potash obtained from the lees of wine was used. In France potash procured from fern seems to have been the alkali used throughout the middle ages.

Although coloured glass is made in very small quantities in proportion to uncoloured, this branch of the manufacture has produced by far the greater proportion of the objects which attract by their beauty, and a few words may therefore fitly be said upon the mode of colouring glass.

The various colours are usually obtained:

Yellow, from charcoal, antimony, or silver; a peculiar canary yellow from uranium.

Red, from sub-oxide of iron, oxide of copper, and from gold, brownish red from protoxide of iron.

Green, from protoxide of iron, oxide of copper, of chromium, and mixtures of oxides of nickel and uranium.

Blue, from cobalt, also from iron.

Amethystine, from manganese.

Brown, perhaps from the same.

Orange, from peroxide of iron with chloride of silver; also, it is said, from arsenic.

Black, from scoria of iron or charcoal.

The art of colouring glass is, however, very subtle and difficult; much depending upon the skill of the artificer in properly adjusting the degree of heat, and very small quantities of added ingredients will often greatly affect the result.

M. Bontemps, at the meeting of the British Association at Birmingham, brought forward some very extraordinary facts in connection with the colouring powers of different bodies. He showed that all the colours of the prismatic spectrum might be given to glass by the use of the oxide of iron in varying proportions, and by the agency of different degrees of heat; the conclusion being that the different colours are produced in their natural disposition in proportion as the temperature is increased. Manganese, copper, silver, gold, and charcoal were all found to produce corresponding results; gold, for instance, giving a great many tints varying from blue to pink, red, opaque yellow, and green. M. Bontemps was of opinion that, in the case of manganese, light is the agent which produces change, and doubted whether any change in the oxidation of the metal will explain the photogenic effect. He is disposed to refer the chromatic changes in most, if not in all cases, rather to some modifications of the composing particles than to any chemical changes in the materials employed.

Although the general practice has been, and is, to employ the oxide of some particular metal to produce a particular colour, the analysis of ancient glasses has shown both that various colours

have been obtained from the same metal, and that various metals will produce very similar colours: for example, the Roman opaque red glass generally contains copper, but a recent analysis made in London showed that oxide of iron and not copper was at least in one case present.

A few words may be said here on the subject of the iridization of glass. Few persons can have failed to observe the wonderful beauty of the tints occasionally seen in ancient examples of glass which have been subjected to a process of decay, and certainly no other product of human art ever exhibits such brilliancy and vividness of colour: in natural objects alone beauty of like kind can be found. The cause of this charming effect is the separation of the surface of the glass into extremely thin films, which refract and decompose the rays of light. That such is the case may be shown by dipping a piece of glass into water, which saturates the films and unites them temporarily into one transparent mass with the central undecayed portion; the colours then disappear, to appear again as soon as the water evaporates and the films again become separated by intervening air. It will be found that coloured glass, and perhaps specially green and blue transparent glass, produce finer colours when iridescent than ordinary uncoloured glass. The iridescence of the glass vessels which are now so conspicuous in shop windows is said to be obtained by the exposure of the object to the action of a much diluted acid at a regulated temperature in a closed vessel. It may be surmised that the effect of this proceeding would be to produce on the surface of the object extremely minute indentations, which would reflect and decompose light, and iridescence would thus be produced in the same manner as it is on mother-o'-pearl, in which last case it is due to the presence of a great number of extremely minute channels with bright polished sides which furrow the surface. In both these cases it is possible that extremely thin translucent films exist, and that light is therefore both refracted and reflected.

As regards the manipulation which the production of objects of

glass requires, all that need be said here is that the constituent materials being mixed in due proportions are fused together in earthen pots, and that the glass, when in a proper state, is either cast, drawn out in rods, or blown; the peculiar tenacity of the substance allowing the latter very peculiar process to be adopted. Glass-blowing was discovered at a very early date, for the process is represented in paintings in a tomb at Beni Hasan in Egypt, dating from the reign of Osirtasen the first, at least 2,000 years B.C. The deviser of it must have been a man of great acuteness and originality, for the invention of glass-blowing is perhaps more wonderful than that of glass itself.

The glass vessel, after it is formed, has to go through the process of annealing or slowly cooling, which greatly diminishes its liability to sudden fracture. Annealing in oil is said to increase its toughness in a material degree. This practice has of late been brought prominently before the notice of the public as if a new invention, but has really been known for some time, and is mentioned in the article on glass in Ure's "Dictionary of chemistry." Polishing is not ordinarily given to blown vessels but is required when an object has been cast, as plate glass; or when it has been, as it is commonly called, cut.

A sketch of the history of glass making may be conveniently divided into the following sections:

Glass in Egypt, Phœnicia, and Greece.

Glass in Rome and the provinces of the Roman empire.

Glass in Byzantium and the provinces of the Eastern empire.

Glass in Persia, and other parts of the east not subject to the Greek emperors, and in Egypt after A.D. 639.

Glass in India.
Glass in Italy.
Glass in France.
Glass in Spain.
Glass in the Low Countries.
Glass in Germany.
Glass in the British islands.
Glass in China.

CHAPTER II.

Glass in Egypt, Phœnicia, and Greece.

The art of glass-making has not been, like those of pottery and of metallurgy, a possession of nearly all tribes of the human race in the earliest infancy of their civilization. It does not appear to have been known to the Mexicans or Peruvians, although both had made very considerable advances in civilization and art. Even the Chinese did not possess it at any very early time, for about 200 years B.C. would seem to be the most remote date at which that nation even claims to have practised it; glass is not mentioned by Homer, nor do any fragments appear to have been found by Dr. Schliemann upon the supposed site of Ilium. He has, however, stated that he found in the ruins of Mycenæ some disks of glass which he believes to have been ornaments of doors, and a bead of the same material. It is perhaps hardly too bold an assertion that the knowledge of the art throughout the world springs from one source, namely, Egypt; certainly the most ancient monuments of glass are Egyptian, and we may trace channels of communication by which the art of making it may have been transmitted from Egypt to every part of the globe where it is now or has been practised.

One consequence of this is that objects, though produced in different countries, closely resemble one another, *e.g.*, Egyptian and Phœnician in the earlier ages, and in the later, Egyptian and Roman, nor in many cases can any difference be found between glass made at Rome itself and in the provinces of the empire. So

BOTTLE.
Ancient Egyptian. (1047-'68)

VASE
Ancient Egyptian or Phœnician. (985-'68.)

VASE.
Ancient Egyptian or Phœnician. (991-'68.)

in later times workmen from Venice imitated the products of Murano in Spain, the Low Countries, France, and England. It is therefore very often impossible to ascribe objects to their place of manufacture with the confidence which can be felt in the case of arts more autochthonous than that of glass, *e.g.*, the ceramic. It is but exceptionally that vessels of glass bear inscriptions, and the assistance which inscriptions afford towards the precise identification of objects is usually wanting.

The art was undeniably discovered at a very early period; one so early that the true history of the invention cannot now be traced. Pliny and other ancient authors tell us that it was reported that Phœnician merchants returning from Egypt to Syria with a cargo of natron or soda, when cooking on the sandy beach under mount Carmel, rested their pots on blocks of natron, and that glass was produced in consequence of the heat of the fire causing the alkali to form a flux for the silicious sand. Sir H. Rawlinson remarks upon this that such an accident is more likely to have occurred in Egypt, in many parts of which the soil contains abundance of natron (sub-carbonate of soda) as well as of sand. But (as M. Sauzay observes) a heat of 1,000 to 1,500 degrees is required in order to make the materials of which glass is formed enter into fusion, and it may therefore well be doubted whether such a production of glass in the open air is possible. However, as glass is produced accidentally in the course of some metallurgical operations, such as the smelting of certain ores; and as it is also formed when vegetable substances containing both silica and an alkali, such as reeds and straw, are burnt in large masses (an accident not at all unlikely to have ocurred in Egypt, where huge masses of straw are frequently piled up), the original invention may be due to the acuteness of some one who noticed the fortuitous production of this remarkable substance.

Mr. Franks has truly remarked that the legend told us by Pliny points both to the Phœnicians and to the Egyptians as connected with the early practice of glass making, and it seems very possible

that the art may have been invented in Egypt and carried thence to Phœnicia, where, as Pliny tells us, a small spot at the mouth of the river Belus furnished sand which had sufficed to produce glass for many centuries. The Venetians appear to have imported this sand from thence in later times, and it is probable therefore that the river supplied the silicious element of glass in unusual purity.

Egypt offers us the earliest positive evidences of glass making. Sir Gardiner Wilkinson mentions that glass bottles containing red wine are represented on monuments of the fourth dynasty, more than 4,000 years ago; and, as has already been mentioned, in the tombs at Beni Hasan the process of glass-blowing is represented in an unmistakable manner.

The earliest specimen of glass bearing an inscription from which its date may be ascertained, which has as yet been met with, is the lion's head (*vide* woodcuts) now in the Slade collection in the British museum. This was found many years ago at Thebes by signor Drovetti. It is formed of opaque blue glass of a very bright and beautiful colour (as may be seen from a fractured part), but time has changed it externally to an olive green. Dr. Birch has informed the writer that the hieroglyphics which are on the underside consist, on the right side, of an urceus wearing the "hut" or white crown of the upper world or upper Egypt, and representing the goddess Sati (Juno), on the left side an urceus wearing the teshr or red crown of the lower world or lower Egypt, and representing the goddess Nat or Neith (Minerva), while the central hieroglyphics form the prenomen of Nuantef IV. of the eleventh dynasty, whose date according to Lepsius' chronology was B.C. 2,423

—2,380. A bead found at Thebes bears the prenomen of Hatasu, a queen who is conjectured to have lived about 1,450 B.C.: this is of a dusky green glass, quite transparent, and is stated to have the specific gravity of bottle glass. It has been suggested that the material is not artificial glass but obsidian, which abounds in Egypt and occasionally of a green tint. Many coloured fragments are found in the tombs of Thebes, and a vitrified coating, usually blue or green, was given to objects formed of earthenware and even of stone or granite.

A high value seems to have been attached to coloured glass at an early date; and vessels of fine opaque blue glass of Egyptian manufacture exist, edged with a tolerably thick plating of gold. Glass, if the Syrian, Greek, and Latin versions of the Old Testament are correct, is placed (in the book of Job) in the same category as gold; the English version renders the word crystal.

As the objects of glass of Egyptian fabrication rarely bear inscriptions it is not easy to trace the progress of the art in that country; but as they are met with not unfrequently in tombs in Egypt it is probable that the manufacture continued to flourish as well during the period of the native monarchy as in that of the Greek dynasty; and its importance after the Roman occupation was probably even increased by the new market thus opened for its products. Hadrian, in a letter addressed to the consul Servianus, when enumerating the chief industrial occupations of the inhabitants of Alexandria includes among them that of glass-blowing. The ordinance, also, of Aurelian, that glass should form a part of the Egyptian tribute, shows that the manufacture in that country and the importation into Rome continued in the latter part of the third century.

That there was considerable similarity between the glass manufactures of Egypt and of Phœnicia may be inferred, among other circumstances, from the accounts we have of immense statues and obelisks in both countries, said to be of emerald but no doubt of green glass. Herodotus tells us that he saw in the temple of Hercules at Tyre a statue or column of emerald; Pliny mentions,

on the authority of Apion, a statue of Serapis thirteen feet and a half high in the Egyptian labyrinth, and, on the authority of Theophrastus, an obelisk sixty feet high composed of four emeralds in a temple of Jupiter in Egypt. It is probably not safe to assume that all glass objects found in Egyptian tombs were really made in Egypt, but many specimens found both there and elsewhere bear clear marks of the art of that country; and this is equally true of the manufacture of the three or four centuries before, as of the three or four after, Christ.

The common Egyptian glass is of dusky green colour and shows little sign of disintegration, partly, no doubt, in consequence of the dryness of the climate. The analyses made by professor John, of Berlin, show that blue opaque glass found at Memphis owed its colour to copper; some other specimens of a like kind contained copper with traces of iron; semi-transparent blue from Memphis was coloured by cobalt; violet also from Memphis with manganese; and black with iron; the semi-transparent blue also contained some lime. Sir Humphry Davy's examinations show like results; he found copper in Egyptian blue and green pastes, but he says that the transparent blue vessels found in Magna Græcia owed their colour to cobalt.

What has been said above applies solely to glass undoubtedly of Egyptian origin. It would seem, however, that the same processes were employed in Phœnicia and Egypt some centuries before Christ, and in Phœnicia, Egypt, and Rome, for some centuries after. It will be more convenient, therefore, to speak of the processes common to the former countries when treating of Phœnician, and of those common to all three when speaking of Roman glass.

Next in date to the earlier Egyptian examples mentioned above would appear to be the vase of transparent greenish glass found in the north-west palace of Nineveh, and now in the British museum. On one side of this is engraved a lion and a line of cuneiform characters, in which is the name of Sargon, king of Assyria B.C. 722. Fragments of coloured glasses were also found there, but our mate

rials are too scanty to enable us to form any decided opinion as to the extent to which the art was carried in Assyria. Many of the specimens discovered by Mr. Layard at Nineveh have all the appearance of being Roman, and were no doubt derived from the Roman colony, Niniva Claudiopolis, which occupied the same site.

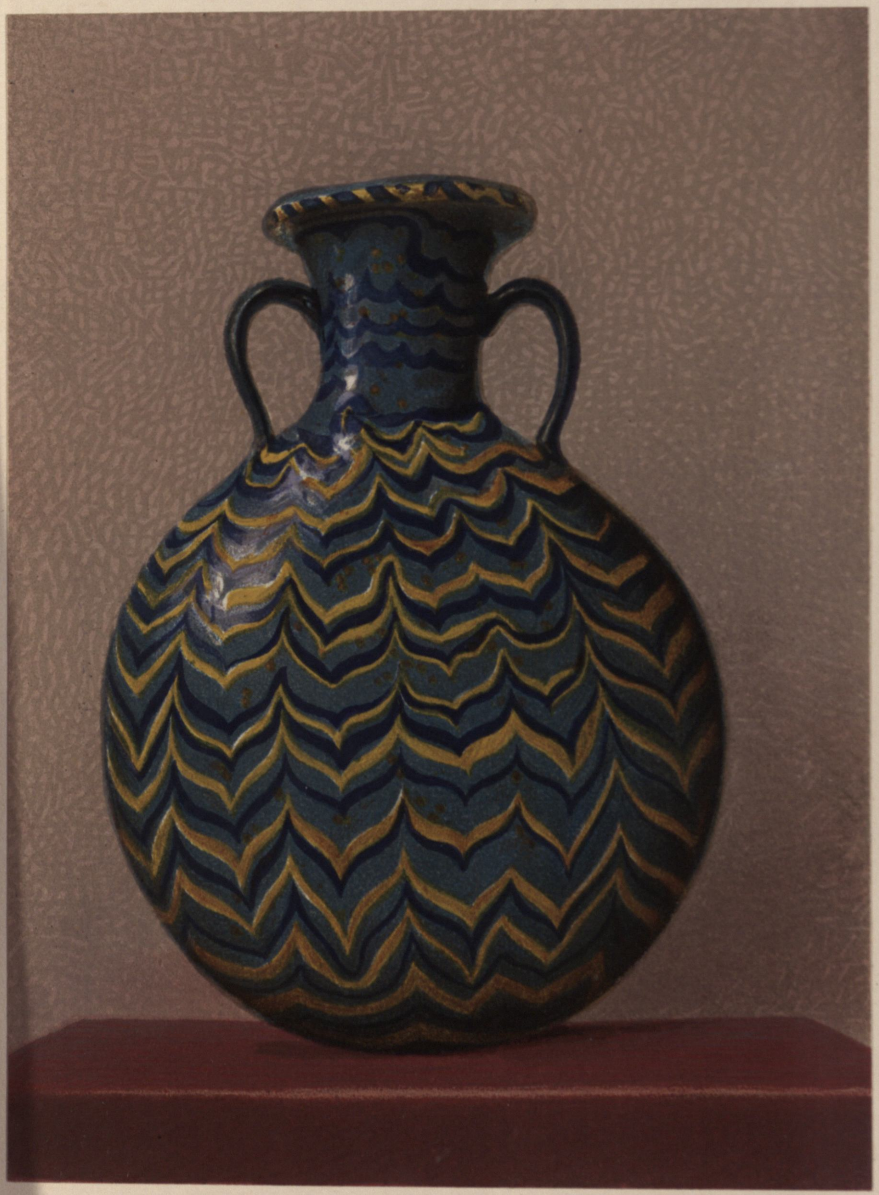
It seems probable that the earliest products of the industry of Phœnicia in the art of glass making are the coloured beads which have been found in almost all parts of Europe, in India, and other parts of Asia, and in Africa. The "aggry" beads so much valued by the Ashantees, and other natives of that part of Africa which lies near the Gold Coast, have probably the same origin. These coloured beads are usually of opaque glass; they exhibit great variety of colour and pattern, and very different degrees of skill in manipulation. Their wide dispersion may be referred with much probability to their having been objects of barter between the Phœnician merchants and the barbarous inhabitants of the various countries with which they traded. It is probable that many of the numerous specimens which exist in our museums date from times several centuries later than those in which Tyre and Sidon flourished; for glass in various forms was an article imported in the first and second centuries, as well into the markets of the Red Sea as into the ports of Britain. Even at the present day beads are made at Venice for export to Africa which bear a resemblance, doubtless not accidental, to those which we have reason to believe are of very early date.

Among the beads found in Great Britain are some of remarkable size and beauty; these have sometimes been the objects of a superstitious veneration, and in Wales and Ireland they have been called Glain neidr (adder's egg), Gleini na Droedh (Druid's beads), serpent stones, &c. Some antiquaries have considered them to be the representatives of the "ovum anguinum," the origin of which, viz., from the saliva of a number of congregated snakes, is told in much the same manner by Pliny and in the popular legends of Wales, Scotland, and Ireland. But it is obviously rather improbable

that such ideas as to the origin and mystical virtues of these beads can be of a date as early as when they were articles of commerce: it is more likely that they have grown up at a time when the real origin of the objects was unknown, and when, like the aggry beads in Africa, they were only occasionally found in the earth.

Many of the beautiful little vases found in tombs in the countries whose coasts are washed by the Mediterranean, and which are generally called Greek, are, there is good reason to think, the products of Phœnician industry. M. Labarte, indeed, considers it certain that manufactories of glass vessels were established, at a very remote period, in Sicily, the islands of the Archipelago, and Etruria. The close similarity, however, of the vessels of this class to each other, whether found in the Greek islands, in Egypt, or in Italy, would lead us rather to suppose that they were produced in a few contiguous cities than in many places widely separated from each other. In the latter case, the difference of materials within reach could scarcely fail to cause appreciable dissimilarity in the products, even if the makers were colonists of one and the same original stock.

The vases of this class have usually the forms of either *alabastra* or *amphoræ;* the prevailing colour is a deep transparent blue, but not unfrequently the colour of the body of the vase is some shade of pale buff, fawn, or white (an imitation more or less exact of arragonite or Egyptian alabaster), sometimes deep green, and, in rare cases, red. In almost every example the surface is ornamented by bands of colour, white, yellow, or turquoise blue, forming zig-zag lines; in some there are only two or three such lines, and in others the whole surface is covered by them. These lines are incorporated with the surface of the vessel but do not penetrate through its entire thickness. Examination of the interior will, in many cases, show that it is rough and bears the appearance of having been moulded upon a core of sand; this, however, appears to be less clearly so when the example is of a characteristically Egyptian form and colouring and has been found in Egypt. It is



VASE.

Ancient Egyptian or Phœnician. (1066-'68.)

difficult to obtain a sufficient number of fractured specimens to allow a decided opinion to be formed.

By far the greater number of the vessels of this class which are preserved in museums will be found to bear forms much more Greek than Egyptian, as that of the *œnochoe* with a trefoil lip and a handle. No. 1047. '68 in the South Kensington collection, however, affords an example quite Egyptian in character, and in the British museum are several like specimens.

By the Greeks and Etruscans these vases were evidently much valued; and amphoræ have been occasionally found in tombs, furnished with a stand of gold. In Rhodes and elsewhere they have been found associated with objects which make it probable that they do not date from an earlier period than the third or fourth century before Christ, and it does not appear that they are met with in tombs later than the Christian era; when coloured or ornamented glass vessels are discovered after that time they are of a different character.

In the British museum are many pieces of glass found at Ialyssos, in Rhodes; they are chiefly disks, varying in size from that of a sixpence to that of a florin, and oblong plates about $1\frac{1}{4}$ inch long by $\frac{3}{8}$ths wide; these last are divided into compartments, in each of which is a spiral; the disks bear elegant rosettes. These ornaments are all in relief, and have evidently been produced by pressure from a mould or die. One plate bears a figure of an animal, probably a lion, bearing a resemblance to the figures of lions in gold found at Mycenæ by Dr. Schliemann. The colours are turquoise blue and some others, among them apparently white or grey, but the disintegration of the surface of many pieces makes it a difficult matter to decide what the colour really is.

Dr. Schliemann (v. page vii.) has stated that he found in his excavations at Mycenæ disks and other pieces of vitreous pastes, which he believes to have been used as decorations for doors or other like uses. These would appear to be of much the same character as those found at Ialyssos. As drops of glass were found

with the ornaments at Ialyssos it would seem that all were made there, but doubt has been expressed whether the drops are not of later date. The drops are chiefly or wholly of uncoloured glass, and if the opinion of their more recent date be founded upon their less advanced condition of decomposition it may be erroneous, for uncoloured glass is much less liable to decomposition than coloured containing large quantities of iron, copper, or other metallic bases. Dr. Schliemann has expressed a doubt whether some of the disks found at Mycenæ are not composed of pottery. Some disks in the British museum brought from Egypt, which resemble those found at Mycenæ and Ialyssos, would seem to be composed of glazed pottery; but it is often difficult to distinguish between various kinds of opaque glass and pottery, unless the object be submitted to careful examination.

In Etruscan tombs in Italy are also found glass vessels of a different character; these are small bowls resembling in form the half of an egg; they are usually of the variety of glass which is mentioned further on as "madrepore," the ground green and transparent, the stars yellow; patches of colour (of gold and of filigree glass) are also sometimes interspersed. They differ from and appear to be earlier than the madrepore glass, fragments of which are so often found in Rome. Another variety found in tombs in the same district is of blue and opaque glass with much gold leaf, the whole twisted together; the most frequent form in which this kind of glass occurs is that of a bottle several inches long and about one inch in diameter, without a neck, having probably had a mounting of gold. Both these varieties are possibly the product of Phœnician workshops, though they are usually classed with Roman glass.

The Greeks of the period before our era do not seem to have much cultivated the art of glass making. Herodotus no doubt refers to the substance when speaking of stony molten pendents, with which he says the ears of the sacred crocodiles in Egypt were adorned: but as he does not use the Greek word ὑαλος, and writes of the emerald column which he saw at Tyre as if it had been a

real emerald, it may be inferred that he was not in reality conversant with or well informed as to the real nature of glass.

The earliest Greek writer who has been observed to use the word ὕαλος is Aristophanes who, in the "Acharnians," makes the Athenian ambassadors sent to Ecbatana assert that they drank there from cups of gold and of glass, and in the "Clouds" he describes the effect of a burning-glass. In the latter passage, however, the material is said to be a transparent stone bought in the apothecaries' shops, and it is doubtful whether glass was really meant. Claudian's assertion that Archimedes made a sphere of glass at Syracuse can hardly be admitted as a historical proof of the manufacture of glass at that period in that city.

Glass, beyond we believe all dispute, was occasionally used for purposes of architectural decoration during the best period of Grecian art; for Stuart and Revett when describing the temple of Minerva Polias at Athens give the following note :—" A remarkable singularity observed in the capitals of this portico is in the plaited torus between the volutes having been inlaid at the interstices with coloured stones or glass." Mr. H. March Phillipps informed the writer, when calling his attention to this passage, that he well remembers having observed these decorations and that he believes them to be of blue glass.

An example of the employment of glass in a like manner is indicated by the odd story which Pliny tells that on the tomb of Hermias, a prince of the island of Cyprus, was a marble figure of a lion with eyes of emerald, which shone so brightly into the sea that they frightened away the tunnies from the adjacent fisheries, so that it became necessary to change the eyes. In the great marble lion discovered by Mr. Newton near the peninsula of Cnidus, and now in the British museum, in the place of the eyes are deep sockets which probably, like those of the Cypriote lion, were filled with coloured glass.

CHAPTER III.

Glass in the Roman empire.

The increasing wealth and luxury of Rome which accompanied the establishment of the empire had among their more important effects that of stimulating the manufacture of glass, and this ultimately reached a point of development which in some respects has never been excelled nor even perhaps equalled. It may appear a somewhat exaggerated assertion that glass was used for more purposes and, in one sense, more extensively by the Romans of the imperial period than by ourselves in the present day; but it can be borne out by evidence. It is true that the use of glass for windows was only gradually extending itself at the time when Roman civilization sank under the torrent of German and Hunnish barbarism, and that its employment for optical instruments was only known in a rudimentary stage; but for domestic purposes, for architectural decoration, and for personal ornaments, glass was unquestionably much more used than at the present day.

That glass was highly and deservedly esteemed as a material of what we should now call works of vertu is evidenced by the high prices paid for fine samples (for instance, the 6,000 sestertii which Pliny tells us were paid, in the time of Nero, for two small vases), and also by the interest several emperors took in the products of the manufacture; among these we may specially notice Tacitus, a man of letters and a collector, of whom Vopiscus tells us that "vitreorum operositate atque diversitate vehementer est delectatus." The Portland vase in the British museum and the vase at Naples,

to mention one kind of glass manufacture alone, show how well deserved was the enthusiasm bestowed upon such objects by the dilettanti of Rome.

These and similar vessels, sculptured like cameos, are perhaps the most beautiful objects which the glassmakers of any period have produced, but many vessels of white glass or of glass of only one colour show the greatest elegance of form; and the ingenuity and invention which devised so many modes of ornamentation and so many shades of colour, and the skill with which the manual execution is carried out, alike demand our admiration. The prodigious variety seems to show that glass making was at that time carried on, not as now in large establishments which supply great quantities of articles identical in form and pattern but by many artificers, each working on a small scale. This circumstance enables us to understand why very pure and crystalline glass was, as Pliny tells us, more valued than any other kind. Long-continued fusion in large vessels is required to produce glass very pure and free from striæ and bubbles; this the system of working among the ancients did not allow, and their glass is in consequence remarkable for the great abundance of bubbles and defects which it contains.

Glass was used at Rome in prodigious quantities; even now, after the lapse of some 1,300 or 1,400 years, the abundance of fragments of coloured glass (to say nothing of uncoloured) which are found in and around the city is surprising. The writer, during about four months of a residence in Rome in the winter of 1858-1859, saw in the hands of the dealers in antiquities fragments of at least 1,000 to 1,200 vessels of coloured and ornamental glass; for the most part the crop, so to speak, of that season. Among these were pieces of at least ten or twelve vessels with white figures in relief on a blue ground, of the same kind as the Portland vase, and in the South Kensington collection are specimens of a like character.

It is not to be wondered at that coloured and highly ornamental glass should have been very largely used among the Romans

for all those domestic purposes in which a decorative effect is desired such as table services, vessels for toilet use, and the like, when we remember that porcelain was not then invented, and that Samian ware was the most decorative kind of pottery which was at their command. The brilliancy of glass as regards both surface and colour made it attractive, and fashion caused it to be preferred even to the precious metals. Not only the invention and ingenuity employed by the Roman artisans in producing variety in glass vessels are most remarkable, but almost every means of decoration appears to have been tried, and many methods of manipulating glass which have been considered new have in reality been anticipated by the glass-workers of that period. Probably not a few of the ingenious processes of the Venetian glass makers were suggested to them by the examination of ancient examples.

In order to appreciate fully the skill of the glass-makers of the imperial period it is necessary to study not only the entire vessels which have been preserved but also the fragments which (as we have just said) are found so abundantly in the ruins of Roman cities. Entire vessels of an ornamental character are comparatively rare, for though urns of common uncoloured glass are frequently met with as receptacles of the ashes of the dead, it was not usual to place precious vessels in the sepulchres; some few have been thus preserved to us, one especial instance being the Portland vase deposited in a sarcophagus which has been supposed to have been that of Alexander Severus. A certain number of ornamental vases have been found at Pompeii and Herculaneum, and a very few, after centuries of wreck and devastation, have survived in the treasury of some church or convent.

According to Pliny, glass was originally made from sand and natron alone; but afterwards the "magnes lapis," possibly manganese, was added, and many kinds of shining pebbles "calculi splendentes," shells, and various sands dug up from the earth, "fossiles arenæ." In India, he says, crystal was employed; and hence it was that no glass was to be compared with the Indian.

During the melting "cyprium" was added, and "nitrum," especially the "ophirium." By the former, copper is generally to be understood, but chalk or some other mineral obtained in Cyprus may be intended. What is meant by "ophirium" is not certainly known but it may indicate a kind of nitre brought from Ophir. Such, he says, was the "antiqua ratio vitri" and he seems to imply that at Sidon glass was made in this manner. In his own time a fine white sand was found on the shore between Cumæ and Liternum, which was pulverized, mixed with three parts of "nitrum," and twice melted. It was then called "ammonitrum," which being again melted became "Vitrum purum ac massa vitri candidi." He adds that in Gaul and in Spain sand was similarly treated. The lumps of glass so obtained were, it would seem, brought to Rome, and there mixed with the colouring ingredients and re-melted.

A passage in Strabo's geography is worth notice with reference to the practice of glass making at Rome: he tells us that he had heard from the glass makers at Alexandria that a certain earth was found in Egypt without which the more elaborate and many-coloured wares could not be made; and it was said that at Rome many things were to be procured which facilitated both the colouring and the working, and the giving it a crystalline appearance; insomuch that a cup might be bought there for a small piece of copper money.

The coloured and variegated glass and glass vessels made in Rome seem to have been articles much exported; for fragments have been found at Cimiez near Nice, at Nismes, and in London, of shades and mixtures of colours and of patterns, so precisely the same as those found at Rome as to render it almost certain that they were all made at one and the same place. We may see from Pliny's notice of glass, in his natural history, that many varieties were produced in his time: he speaks of an opaque red, of white glass, and of glass imitating murrhine, jacinths, sapphires, and all other colours. He also makes special mention of black glass, like obsidian, which was used for vessels on which to serve food.

Examples of many of these kinds may be seen in the South Kensington collection, with the possible exception of the murrhine. The question as to what the real murrhine was has often engaged the pens of classical scholars but has never been satisfactorily solved. Some light may perhaps be obtained by comparing the description which Pliny gives with specimens of ancient glass, among which we might fairly expect to discover the imitation murrhine. Pliny tells us that the colours of the real murrhine were purple, white, and a third "ex utroque, ignescente veluti per transitum coloris purpura aut rubescente lacteo." Now among the fragments of glass found at Rome and elsewhere specimens are occasionally to be met with of a very beautiful transparent purple, mixed with veins and lines of opaque white; where this white has a thin covering of the purple glass a colour is seen which corresponds with Pliny's description. It has been thought that by murrhine the ancients meant fluorspar, but no glass has been noticed which resembles this substance. A more probable opinion seems to be that murrhine was a variety of agate containing shades of red or purple. It is possible, also, that those red or purple shades were produced by heat or other artificial means, as practised so largely at the present day in India and in Germany, both with onyxes and crystals. The kind of glass which Pliny speaks of as most highly esteemed in his time was the pure white, imitating crystal: this may have been not only in colour and transparency but also in thickness.

The Romans had at their command, of transparent colours, blue, green, purple or amethystine, amber, brown, and rose colour; of opaque colours, white, black, red, blue, yellow, green, and orange. There are numerous shades of the former as well as of the latter, particularly of transparent blue, and of opaque blue, yellow, and green. Of opaque colours many varieties appear to be due to the mixture of one colour with another. In any large collection of fragments it would be easy to find eight or ten varieties of opaque blue, ranging from lapis lazuli to turquoise or to lavender, and six

BOTTLE
Ancient Roman. (999–'68.)

MEDALLION.
Ancient Roman. (8990–'63.)

SLAB (a fragment).
Ancient Roman. (1077–'68.)

or seven of opaque green. Of red the varieties are fewer; the finest is a crimson red of very beautiful tint, and there are various gradations from this to a dull brick red. One variety forms the ground of a very good imitation of porphyry, and there is a dull semi-transparent red which, when light is passed through it, appears to be of a dull green hue.

The analyses of antique glass of this period, which were made by Klaproth, show the following results. No attempt to determine the quantities of alkalies, it should seem, was made.

OPAQUE RED FROM THE VILLA OF TIBERIUS AT CAPRI.

In 200 grains,	Silica	142 grains.
	Oxide of lead	28 ,,
	Do. copper	15 ,,
	Do. iron	5 ,,
	Alumina	2 ,,
	Lime	3 ,,
		195 ,,

OPAQUE GREEN.

I 200 grains,	Silica	130 grains.
	Oxide of copper	20 ,,
	Do. lead	15 ,,
	Do. iron	7 ,,
	Lime	13 ,,
	Alumina	11 ,,
		196 ,,

PARTIALLY TRANSPARENT BLUE FROM CAPRI.

In 200 grains,	Silica	163 grains.
	Oxide of iron	19 ,,
	Alumina	3 ,,
	Oxide of copper...	1 ,,
	Lime	0·5 ,,
		186·5 ,,

Another specimen of blue Roman glass, analysed by professor John, showed the presence of cobalt. It has been ascertained

that the rose-coloured glass owes its colour to gold, the violet to manganese, the white and orange to oxides of tin and of arsenic. A specimen of fine opaque red lately analysed in London proves to be coloured by iron. With these colours the Roman *vitrarius* worked, blending them in almost every conceivable combination—sometimes, it must be owned, with a rather gaudy and inharmonious effect.

Combinations of colour were effected in two ways: first, by glasses of two or more colours being combined so as to traverse the entire substance of the object; and, secondly, by the superposition of the one colour on the other.

To the former class belong all those termed mosaic and mille fiori where the process of manufacture was the preliminary union, by heat, of threads of glass into a rod, which when cut transversely exhibited the same pattern in every section. Such rods were often placed together side by side, and united by heat. This process was no doubt first practised in Egypt, and is never seen in such perfection as in objects of a decidedly Egyptian character in design or in colour. Very beautiful pieces of ornament of an architectural character are met with, which probably once served as decorations of caskets or other small pieces of furniture, or of trinkets; also tragic masks, human faces, and birds. Some of the last-named are represented with such truth of colouring and delicacy of detail that even the separate feathers of the wings and tail are well distinguished, although the piece which contains the figure may not exceed three-fourths of an inch in its largest dimension. An exquisite work, a figure of a human-headed hawk, is in the British museum.

The patterns were made first on a large scale, then the glass rod, when hot, was drawn out until its diameter was reduced to the size we see. That such was the case is evident from a careful examination of some of the pieces, as the work is evidently more minute than human powers could otherwise accomplish: *e.g.*, in a specimen in the British museum (No. 93 in the catalogue of the Slade collec-

tion) where are represented a small human bust and head, with a lock of hair hanging over the forehead: this lock is not much broader than a horsehair, yet, when examined with a powerful lens, it is seen to be composed of nine threads alternately of transparent and opaque glass. Although, as before noted, the finest works of this description were made by Egyptian craftsmen, many of those found at Rome were probably made there, and fragments of the rods are occasionally discovered. One of these, in the possession of the writer, is quadrilateral, about $\frac{3}{4}$ inch square, and shows a four-leaved flower of turquoise blue with a yellow centre, on a ground of opaque red.

The same process was used in the manufacture of objects much larger than those mentioned above, and plates 4 to 6 inches square are met with. The execution of these is much less minute and delicate; the subjects are usually flowers; particularly poppies, ears of corn, and the like.

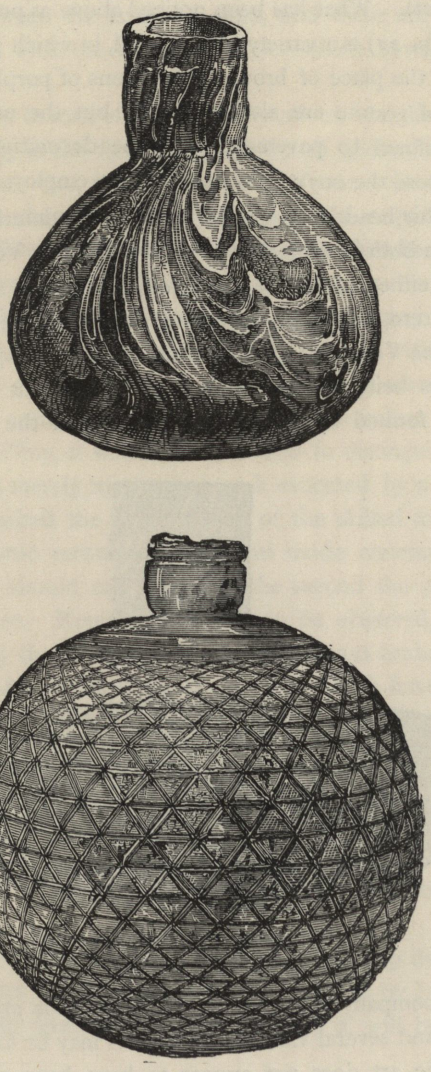
A very few examples have been noticed of a process of the same nature, but somewhat differently managed. In this the figure does not penetrate through the entire substance of the vessel but is inlaid in a cavity hollowed out to receive it to the depth of about $\frac{1}{16}$ of an inch. The only specimens hitherto met with represent fishes on a ground of opaque turquoise blue. One specimen has the head and about half the body of a fish, which if entire would measure 3 to $3\frac{1}{2}$ inches in length. It is executed with the greatest minuteness, and the teeth, divisions of the fins, and of the eyeball and eye, are represented with great truth both of form and colour. These figures might have been made in two ways: either by using a rod or cane of the required form and cutting off transverse sections, which being placed in the cavities prepared for them were fixed by the action of the furnace; or the cavity may have been prepared, the various colours placed in their proper situations in the condition of powder worked into a stiff paste with some suitable vehicle, and an amount of heat applied sufficient to unite them and cause them to blend, without producing liquefaction.

A somewhat similar result was also obtained by different means, which it may be worth while to describe at more length, as it may afford a useful hint to artists in mosaic. The variously-coloured glasses were broken or cut into fragments of suitable sizes and forms, placed together and a mass of heated glass poured or pressed on the back; thus the pieces were united and in some degree blended together, and a figure was obtained with less of hardness than a mosaic and more of the effect of a painting. In the possession of the writer is the upper half of the head of a female figure formed by this process, which when entire must, if standing, have been not less than 15 inches high. Such figures, it would seem, were then used in the "opus sectile" or marquetry with which walls were covered.

A common variety of mosaic glass was made by combining square sticks of various colours, the effect produced being that of tesselated work. Small cups were made of this pattern, but only in very rare cases of the more artistic patterns. In the Louvre is a mass of this tesselated pattern, which, being rounded at one end, shows that the sticks of which it is composed were placed together in a small pot and there heated until they cohered.

A vast quantity of bowls, cups, and pateras were made by the same means in patterns which bear considerable resemblance to the surfaces of madrepores, and are of the same kind as those which by the Venetians are termed "mille fiori." In these, every colour and every shade of colour seem to have been tried in great variety of combination with effects more or less pleasing; but transparent violet or purple appears to have been the most common ground colour. Although most of the vessels of this mille fiori glass were small, some were of large size; a fragment in the possession of the writer must have formed part of a dish not less than 20 inches in diameter.

Another variety of glass, evidently much used, is that in which transparent brown glass is so mixed with opaque white and blue as to resemble onyx. This was sometimes done with great success,

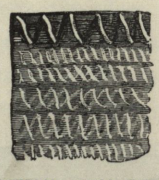


Ancient Roman glass bottles: South Kensington museum.

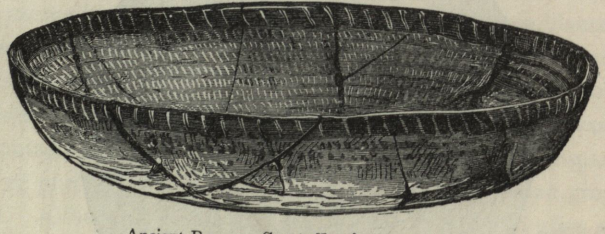
and very perfect imitations of the natural stone were produced

(*see* woodcut). What has been noticed above as possibly imitation murrhine (p. 22) is a variety of this kind, in which purple or violet glass takes the place of brown. Imitations of porphyry, of serpentine, and of granite are also met with; but the use of these was almost confined to pavements and the decoration of walls, for which purpose the onyx glass was likewise employed.

Under this head must also be included the interlacing of bands and threads both of white and of coloured glass. Vessels are found composed either of bands so placed in sections as to present a plaited pattern, or simply arranged side by side; others, again, resemble the Venetian vitro di trina, threads of opaque white or yellow glass being twisted with clear transparent glass, and the vessel then formed by the welding together of the rods so made,



. DETAIL . FULL SIZE.



Ancient Roman: South Kensington museum.

as in the accompanying woodcut. Blue threads are occasionally intermixed, and several varieties of pattern may be found; but this branch of the art does not appear to have been carried by the Romans to anything like the perfection to which it was afterwards brought by the Venetians. Pieces of gold leaf are sometimes

introduced between the layers of glass, and these are frequently seen combined with the bands of colour which have just been mentioned.

To the second branch of decoration by colour, viz., that by superposition, belong, in the first place, the cameo glasses, such as the famous Portland vase, in which a paste of one colour has been placed over another and then carved into the required design: this, no doubt, is what Pliny meant to describe when he says 'aliud argenti modo cœlatur." The sculpturing was, no doubt, mainly executed by the lapidary's wheel, but the work may have been finished with the help of a diamond, or by attrition with a file composed of emery or adamantine spar, formed into a mass with pitch or some other resinous substance, like the corundum file of the present day. Pliny, it would seem, wished to distinguish between that which was merely mechanical work executed by a wheel, and that which required the manipulation of the skilled artist, for he says "aliud torno teritur, aliud argenti modo cœlatur," the first being what we should call cut glass, the second the cameo glass described above. Roman silver, it may be observed, was often ornamented by the same method and not always beaten out from behind. The few entire vases of this kind which have been preserved are remarkable for their exquisite beauty, and the existing fragments usually exhibit traces of good style. Though the Portland vase was found in a sepulchre believed to have been that of Alexander Severus, yet, like the elegant amphora at Naples and the Auldjo vase in the British museum, it shows marks of Greek rather than of Roman art. They all belong to a comparatively early date.

The Portland vase is too well known to make any description of it necessary, but the following remarks upon it by Josiah Wedgwood, when he proposed in 1786 to copy it, will be read with interest:—

"It is apparent that the artist has availed himself very ably of the dark ground in producing the perspective and distance required

by cutting the white away nearer to the ground as the shades were wanted deeper, so that the white is often cut to the thinness of paper, and in some instances quite away, and the ground itself makes a part of the bas-relief, by which means he has given to his work the effect of painting as well as sculpture; and it will be found that a bas-relief, with all the figures of a uniform white colour upon a dark ground, will be a very faint resemblance of what this artist has had the address to produce by calling in the aid of colour to assist his relief. That hollowness of rocks and depth of shade in other parts, produced by cutting down to the dark ground, and to which it owes no small part of its beauty, would all be wanting, and a disgusting flatness appear in their stead. It is here that I am most sensible of my weakness, and that I must of necessity call in the engraver to my assistance in order to produce the highest finished and closest copies we are capable of making. But in this resource difficulties arise, and, I fear, insurmountable ones; for how few artists have we in this branch whose touches would not carry ruin with them to those beautiful and high-wrought figures? and, suppose one or two could be found equal to the task, would such artists be persuaded to quit a lucrative branch of their profession and devote half a life to a single work, for which there is little probability of their being paid half so much as they earn by their present employment? for I do not think 5,000*l.* for the execution of such a vase, supposing our best artists capable of the work, would be at all equal to their gains from the works they are now employed in."

The Portland vase was found before 1644 about three miles from Rome, in a sarcophagus dedicated, as has been supposed, to the emperor Alexander Severus (killed A. D. 325) and his mother. It measures 10 inches in height by 6 inches in width; the glass which forms the ground is dark blue. The amphora at Naples measures 1 foot $\frac{5}{8}$ inch in height, 1 foot $7\frac{1}{2}$ inches in circumference; it is shaped like the earthern amphoras, has a foot far too small to support it, and must no doubt have had a stand, probably of gold; the

greater part is covered with a most exquisite design of garlands and vines, and two groups of boys gathering and treading grapes and playing on various instruments of music; below there is a line of sheep and goats in varied attitudes. The ground is blue and the figures white. It was found in a house at Pompeii in the year 1839, and is now in the royal museum at Naples. The Auldjo vase, one part of which is or was in possession of Mr. Auldjo and another in the British museum, is an œnochoe about 9 inches high; the ornament consists mainly of a most beautiful band of foliage, chiefly of the vine, with bunches of grapes; the ground is blue and the ornaments white: it was found at Pompeii in the house of the Faun.

Costly as these beautiful objects must have been a very great number of them existed, for even now fragments of ten to fifteen may probably be met with in the hands of the curiosity dealers in Rome in the course of three or four months. The same process was used in producing large tablets, employed, no doubt, for various decoiative purposes. No. 1074. '68, in the South Kensington collection is a fragment of such a tablet or slab: the figure, a portion of which remains, could not have been less than about 14 inches high. The ground of the cameo glasses is most commonly transparent blue (often lined with opaque white to throw up the colour), but sometimes opaque blue, purple, or dark brown. The superimposed sculptured layer is generally opaque white. A very few specimens have been met with in which several colours are employed.

At a long interval after these beautiful objects come the vessels which were ornamented either by means of coarse threads trailed over their surfaces and forming rude patterns, or by coloured enamels merely placed on them in lumps; and these, doubtless, were cheap and common wares. But a modification of the first-named process was in use in the fourth and succeeding centuries, showing great ingenuity and manual dexterity; that, namely, in which the added portions of glass are united to the body of the cup, not throughout but only at points, and then shaped either by the wheel or by the hand. The attached portions form in some

instances inscriptions, as on a cup found at Strasburg which bears the name of the emperor Maximianus (A.D. 286-310); on another at Munich; and on a third in the Trivulzi collection at Milan, where the cup is white, the inscription green, and the network blue. A fragment of a cup of this kind is in the British museum. Probably the finest example is a large situla, 10½ inches high by 8 inches wide at the top and 4 inches at the bottom, preserved in the treasury of St. Mark at Venice. This is of glass of a greenish hue; on the upper part is represented, in relief, the chase of a lion by two men on horseback accompanied by dogs; the costume appears to be rather Byzantine than Roman, and the style bad. The figures are very much undercut. The lower part has four rows of circles united to the vessel at those points alone where the circles touch each other. All the other examples have the lower portion covered in like manner by a network of circles standing nearly a quarter of an inch from the body of the cup.

A cup belonging to baron Lionel de Rothschild is connected with the specimens just described. Though externally of an opaque greenish colour it is by transmitted light of a deep red; the colouring matter (Mr. Franks observes) being probably copper, but the glass has not been brought to the state in which it becomes ruby. On the outside in very high relief are figures of Bacchus with vines and panthers, some portions being hollow from within, others fixed on the exterior. The changeability of colour may remind us of the "calices versicolores" which Hadrian sent to Servianus.

Vessels are also found on which coloured enamels have been dashed in spots entering slightly within the surface: although these are but common and ordinary objects exhibiting little or no art, they yet seem to have some bearing upon the interesting question whether enamel-painting upon glass was practised by the Romans. The enamelling is coarse and imperfect, and was probably executed by means of enamel liquefied by heat; not reduced to a fine powder and applied cold, the only means by which delicate execution can be obtained. It is, however, unlikely that when so near an approach

BOWL.

Ancient Roman. (969-'68.)

had been made to the art of enamelling, the last step was not taken by artists so ingenious and so desirous of novelty as were the Roman, and several objects are extant, or have been described, which bear traces of the process. One specimen is in the British museum on which is a figure of a gryphon, drawn apparently in a dark enamel colour. In the Louvre is a small cup of green transparent glass, about three inches in diameter, said to have been found at Nismes; on this figures of animals and foliage drawn in yellow and red are discernible. Von Minutoli speaks of a patera found in the year 1819, at Cumæ, on which a landscape was painted in several colours with decorations in gold : this should now be in the imperial collection at Vienna. Boldetti states that in the cemetery of Callistus, in the catacombs, a cup was found in the bottom of which the head of our Saviour was depicted, not in gold but in several colours. It is not at all surprising that few enamel paintings have been preserved, when it is remembered that almost all Roman glass is found buried in damp places and much corroded on the surface, and that enamel colours corrode more readily than ordinary glass on account of their containing a greater proportion of metallic oxides.

Decisive examples are two cups which were found at Vaspelev in Denmark, engravings of which are published in the "Annaler for Nordisk oldkyndeghed" for 1861, p. 305. These are small cups, 3 inches and $2\frac{1}{2}$ inches high, $3\frac{3}{4}$ inches and 3 inches wide, with feet and straight sides; on the larger are a lion and a bull, on the lesser two birds with grapes, and on each some smaller ornaments. On the latter are the letters DVB. R. The colours are vitrified and slightly in relief; green, blue, and brown may be distinguished. They were found with Roman bronze vessels and other articles. Cav. de Rossi has described and figured (Boll. di archeol. arit. Ann. 1873, tav. iii.) a circular plate of glass found affixed to the wall in an ancient sand-pit a mile outside Rome. It measures $4\frac{3}{4}$ inches in diameter, but is only a portion of a much larger plate. On it are painted birds and fruits, not (the Cavaliere says) in enamel, but "simple painting" (semplice pittura), probably in tempera.

In the fourth and following centuries pictorial representations were made by means of gold leaf, either embedded in the substance of the glass or fixed to its surface. Some hundreds of these have come down to us, in consequence of the Christians of those times having been in the habit of affixing the disks, which formed the bottoms of the vessels thus ornamented, to the exterior of the loculi in which the dead were placed in the catacombs. They offer a series of most curious and interesting representations. Padre Garrucci is disposed to attribute them to the period between A.D. 200 and A.D. 400, but without strictly confining them within those limits.

The subjects are sometimes mythological, but most commonly Christian; on the latter the inscriptions BIBE VIVAS and PIE ZESES very generally occur, and it has been inferred from them that the vessels were used either for sacramental purposes or in the celebration of love feasts. When found entire, which is rarely the case, the vessels are in the form of shallow pateras or bowls.

The process of making them seems to have varied: in some a leaf of gold was fixed on the upper surface of the bottom of a vessel, the superfluous portions were removed, and lines traced through the gold until the desired pattern was obtained; a bowl was then superadded, and the whole united into one mass by fire. In a few instances small portions of the ornaments or figures have colour added; red, lake, blue, white, and two shades of green were thus employed. In the British museum No. 317 of the Slade collection is an important example.

Some of the vessels were decorated with small medallions, each of which forms a portion only of the subject represented, so that several were required to complete the whole. In these the gold design is usually backed with coloured glass, either blue, green, violet, or crimson. The remains of a shallow dish found near Cologne shows such an arrangement; about twelve of the small coloured medallions with which this was studded remain. In other specimens, such as the fragment No. 120 in the Slade collection,

the gold leaf seems to have been applied to the surface of the glass and not protected by a second coating. Such pieces must have been peculiarly liable to receive injury. Enamelled decoration was also occasionally added. A very curious example was found some years ago at Cologne in which the real cup about three inches high is ornamented with winged genii and flowers in gold, and is enclosed in a network of threads of glass, which join handles constructed in a like manner, the whole standing on a foot. The threads of glass are in this instance not cut.

Some examples of this process are to be met with in which the drawing and execution are far superior to those of the majority; the first in correctness, the second in fine and careful shading, in which cross-hatching is sometimes seen. We may refer to Nos. 1051. '68 and 1052. '68 in the South Kensington collection, as of this class. They are occasionally very cleverly executed though usually, according to Garrucci, full of blunders as to costume, errors in inscriptions, &c. Many of them are probably the work of the clever forgers of the Italian renaissance, who caught the spirit of the antique so ably that the objects which they produced in several classes of art have often deceived the most acute connoisseurs. That the artists of about 1500 in Italy were quite capable of executing such work may be seen by many extant specimens, of which No. 3648-56 at South Kensington is a particularly fine example.

The processes which remain to be mentioned are those in which decorative effect was obtained by variety of form; and these are the two which Pliny has indicated in the words "aliud flatu figuratur," and "aliud torno teritur," the first including blowing and moulding, the last grinding and shaping on the wheel. Cameo glass, and that later kind in which portions are attached to the ground at points, ought in strictness to have been spoken of only under this head, but reasons of convenience have led to the arrangement adopted.

Variety of form was given by several processes connected with

that of blowing; for instance, by moulding with pincers or other tools, by making projecting ribs on the sides (now called pillar moulding), as well as by the use of moulds, probably of metal, into which the glass was either blown or pressed: bottoms of bottles and other vessels have often fishes, dragons, or birds thus formed. Cav. de Rossi has figured a cup found in a tomb near Treves, on which are fishes, sepias, and shells, all, it would seem, moulded in very high relief and stuck on. A similar cup was found in the cemetery of Calixtus near Rome. Several cups or fragments of them have been found on which are figures of gladiators with their names; on one found at Chavannes in La Vendée are the names of Proculus, Columbus, and Spiculus, mentioned by Suetonius as having lived in the time of Caligula and Nero. These cups were blown in a mould, not finished by any process of cutting or grinding, and evidently cheap common wares. Some beautiful examples of these processes will be found in the South Kensington collection. Masks and ornaments were likewise often made in a mould and attached to vases, &c.; and one maker has recorded his name and abode, Artis Sidon, both in Greek and in Latin, the words appearing in relief on the handles of cups, as if formed by the use of pincers on which they had been engraved. An elegant long-necked bottle in the British museum seems to have been blown within a mould made by means of a cage of wire; this process has given to its surface little rounded elevations such as we see in the glass which is now so common, and often called "kinkled."

A great number of vessels of various forms, whether cups, pateræ, or vases, were, after they were blown, finished by the wheel, and afford beautiful examples of skill in manipulation, portions being often much undercut. The whole surface was also sometimes cut, not, as in modern times, into projecting pyramids, but into a series of indentations of a curvilinear form. In another class of examples, figures and ornaments were engraved in shallow intaglio; this was evidently done with the lapidary's wheel, and in a few instances (*e.g.* a cup in the museum at Cologne) details were added with the

point of a diamond or other hard stone. Work of this kind is usually bad both in style and in execution, and evidently belongs to a late date. A fragment of a large patera or shallow bowl at Munich has engraved on it the labarum and the letters Alpha and Omega; but perhaps the most important specimen extant is a situla of dark violet glass in the treasury of St. Mark, at Venice, on which a bacchanalian dance is represented. The manufacture of such specimens was probably continued under the Byzantine empire.

In the year 1868 some extraordinary examples of this kind of work were found at Porto, and have been figured and described by De Rossi. The most remarkable were fragments of a patera which must have been about 8 inches in diameter, on one of which is engraved in shallow incavo a standing figure of Christ between two saints; and on another a part of a figure of Christ is represented in the act of delivering a tablet, inscribed "Lex Domini," to a figure probably intended for St. Peter. Cavaliere de Rossi is of opinion that these fragments probably date from the fourth century. The figures are engraved on the under-side, so that the upper remains smooth and fit for use, while the figures seen from above have the appearance of being in relief. De Rossi suggests that they were simply plates for domestic use, but as glass vessels were certainly used in the early centuries for eucharistic purposes it is possible that they were patens. In the "Liber pontificalis" we read that pope Zephirinus (203—221) ordered patens of glass to be carried before the celebrating priest.

One singular method of ornamentation, which does not come under either of the classes mentioned above, is exhibited in a drinking cup in the British museum. A silver cup was made, having the sides pierced with numerous oval apertures; blue glass was then blown into the inside so as to protrude slightly through the openings, giving an effect similar to that of a silver cup studded with sapphires.

Glass was also much used at Rome in the manufacture of artifi-

cial gems; and the story of the jeweller who cheated the empress Salonina, wife of Gallienus, with some false gems shows to what perfection the art was brought. Imitations of emeralds, beryls, and other gems are frequently found. Copies in glass of intaglios and cameos are also met with in great quantity; many hundreds may even now be purchased at Rome, and they are found wherever any considerable Roman town existed. As these were apparently made for people whose means did not enable them to purchase works in real stones they were probably produced, not by engraving, but by pressure in a mould when the material was in a state of semifusion; the cameos themselves were often finished with the wheel. The intaglios, doubtless, were chiefly intended to be set in rings, although some of them are too large for such a purpose. Notwithstanding the great number of specimens that have come down to us, there are but few which are of first-rate excellence as works of art; nevertheless, having evidently been cast from the finest gems of their time, they have preserved to us designs of the greatest beauty with such conditions of unquestionable authenticity as render them of high value to the student of ancient art. Mr. King ("Antique gems," p. 78) cautions us that of the pastes sold as antique in such abundance hardly one in a hundred is genuine, and that any paste (*i.e.* glass intaglio or cameo) appearing never to have had a setting may be looked upon with the utmost suspicion. This is, perhaps, too sweeping: undoubtedly vast quantities are modern, but certainly many are antique although no trace of the setting may remain.

Cameos of glass are sometimes met with of large size; a fine fragment in the British museum in blue opaque paste, imitating lapis lazuli, has the upper half of a human figure which if perfect would be about a foot high, and even larger examples have been noticed; the tablet in the woodcut is a good though smaller example of these camoes made in moulds. Besides human and animal figures, foliage and architectural ornaments are found on them, executed not unusually in glass of vividly contrasting colours, such

as green and bright red; many of these no doubt served as ornaments for pieces of furniture, or for walls of rooms. Circular

Roman tablet in relief: South Kensington museum.

medallions with a head of Medusa in cameo, and of nearly 2 inches in diameter, are not uncommon; for instance, No. 276, '74 in the South Kensington collection. It has been conjectured, with great probability, that these and other medallions of a like kind were worn as *phaleræ* or military decorations by soldiers, or on the trappings of horses. Busts and figures in full relief were also executed; some in moulds, while others were cut as if out of a

hard stone. Many small articles were made of glass, as spoons, children's toys in the form of animals and birds, dice, knuckle-bones, and counters.

One peculiar method of employing glass in the manufacture of personal ornaments requires special mention: that, namely, in which the surface was hollowed in the form of a bird, a leaf, a lizard, or the like, and a very fine fillet of gold made to follow the outline and to mark out the features and members of the object represented; enamels of various colours were then inserted between the lines of gold, and the whole submitted to the action of the muffle furnace. These are sometimes executed with the most exquisite delicacy. The ground is almost always blue transparent glass, backed with opaque white to throw up the colour. In a few instances there is no enamel, but the whole of the incavo is filled with gold. The specimens in which enamel is used are peculiarly interesting, as furnishing early examples of that process of enamelling which we are accustomed to call cloisonné, and which was practised with so much success in Byzantium in the tenth and eleventh centuries.

Glass also played a very important part in the decoration of a sumptuous Roman house: thick pieces of coloured glass added to the brilliancy of the pavement, either in irregular fragments or in larger slabs, so shaped as to form parts of a pattern. Of the first method of using it a good example may be seen in one of the chambers of the house of the Faun at Pompeii, where many fragments of amethystine and of opaque red glass of the most beautiful tint are embedded in the pavement, in conjunction with small pieces of variously coloured marbles fixed in a hard cement, in the manner now called in Italy "alla Veneziana." Of the second kind of pavement, called "sectile," an example formed almost entirely of slabs of glass is represented in pl. i., fig. 4, of Von Minutoli's work; the colours of the glass were white, green, and blue; it was found in the course of excavations made by the duke de Blacas in the year 1820, not far from the portico of the temple of Venus at Rome near the Coliseum. The room to which this pavement belonged

appears to have formed part of a private house of earlier date than the temple which was built by Hadrian. Von Minutoli also mentions that at the Isola Farnese, nine miles from Rome on the road to Viterbo, a pavement of slabs of green glass about the thickness of a tile was found. In the possession of the writer are some pieces of black, white, and orange opaque glass, which were found on the site of the palace of the Cæsars at Rome; they are about half an inch thick, and have been shaped so as to form parts of a pattern. The pieces used in pavements are not only of single colours, but imitate porphyry, serpentine, and various granites. The walls of rooms were decorated in a like manner, and thousands of specimens of the pieces which made up such decorations may be found in the hands of the Roman dealers in antiquities. Examples, however, in which the original collocation of the pieces has been preserved or can be recovered are of the greatest rarity.

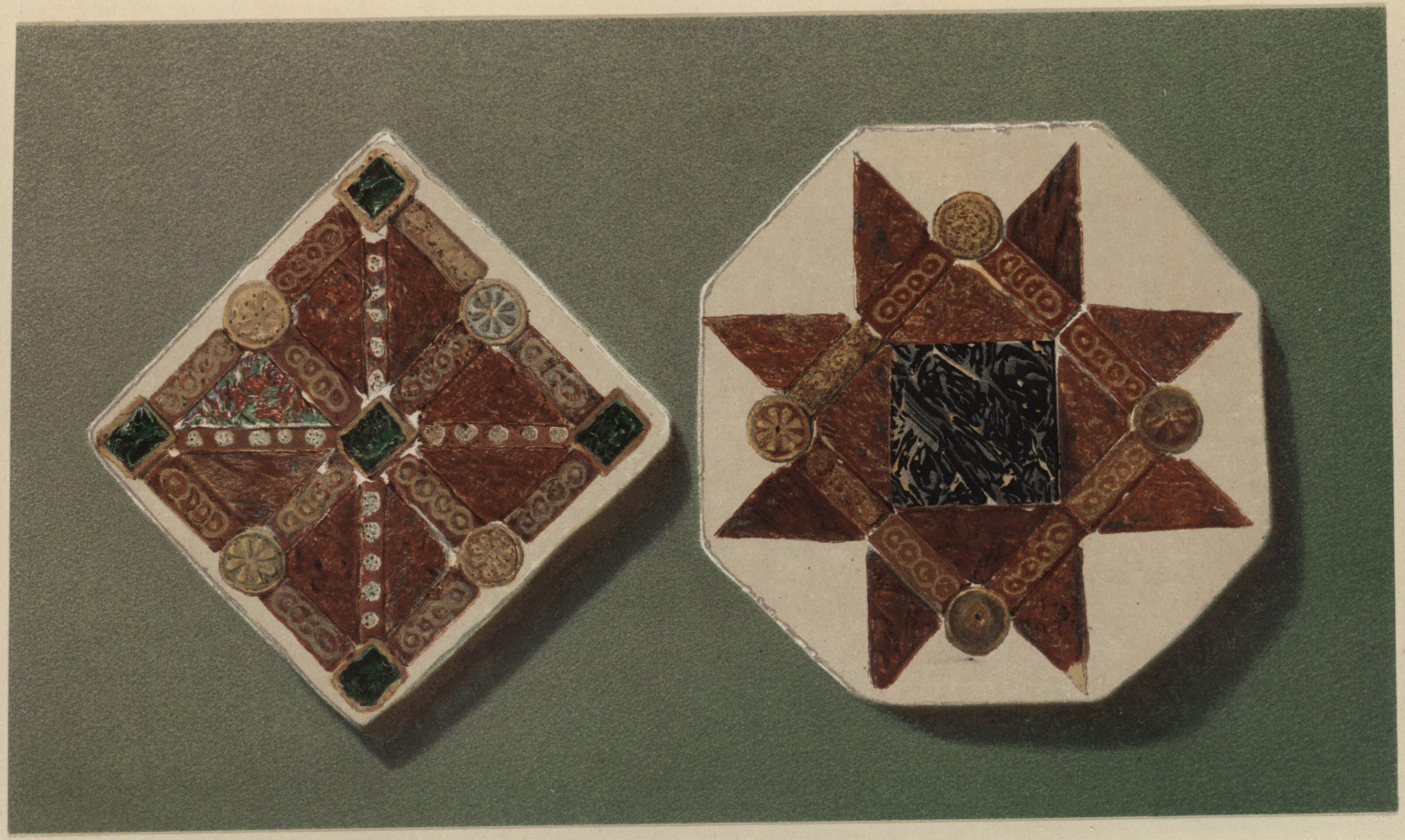
Wall pieces of this kind are much thinner than the pavement glass, and are often of very singular shapes; and it will be frequently seen that when placed together in pairs they form something like the petals of a flower. A few specimens, found at Pompeii and Herculaneum and preserved in the museum at Naples, show the kind of patterns which may be thus obtained; some are star-like, others rosettes, and each is placed in the centre of an octagonal piece of lavender-coloured opaque glass; one of the stars is made of eight pieces of so-called mosaic glass, all cut from the same rod. As these wall pieces were generally ground so as to fit exactly the Romans must have spent upon these decorations an amount of labour which to us, accustomed to ornament our walls with paper or plaster, would appear surprising. Such decorations are alluded to by ancient authors in terms denoting that they were considered marks of great luxury; as Vopiscus tells us of Firmus, "His wealth was much spoken of, for he is reported to have covered his house with squares of glass attached by bitumen and other cements." Seneca contrasts the vaults of the bath chambers of his own day, covered with

glass, with the rude simplicity which marked the times of the Scipios.

Nos. 886 to 895, '75. at South Kensington are instances in which the pieces have been found in such collocation as to admit of the restoration of the patterns; the pieces have been first chipped, and then ground and fitted together with the greatest exactness. They come from the ruins of a villa near Rome which is known to have belonged to Lucius Aurelius Verus, the son-in-law of the emperor Marcus Aurelius.

Another variety of this system of decorating walls in which higher artistic powers were called into use was that in which not merely patterns but subjects containing forms both of animals and men were represented by means of coloured marbles and glass. Very few examples of this description of work have come down to us; by far the most important formed part of the decorations of the hall of the consul Junius Bassus, afterwards the church of S. Andrea in Catabarbara in Rome, now destroyed. Ciampini has represented the building and several portions of the decorations as they existed in his time; and Von Minutoli (pl. 4) has given a coloured engraving of a fragment which is preserved in the palazzo Albani at Rome. This is about 4 feet 4 inches (Rhenish measure) high, by about 4 feet wide; in the upper part the story of Hylas seized by the water nymphs is depicted, while the lower is occupied by a piece of drapery represented as if suspended to the wall. The upper part is chiefly composed of pieces of variously coloured marbles, some portions only being of blue and green glass; in the lower part glass is more freely used. The piece of drapery has a broad border on which are small figures of Egyptian deities and priests; these are entirely composed of glass, and the portion representing the garments is of the kind known as mosaic glass.

In tesselated work (*opus tesselatum*), or what we usually term mosaic, glass was more and more used as the desire for splendour increased; in early examples it is only found employed for the parts requiring very vivid colours, the rest being stone, marble, and baked



FRAGMENTS OF MURAL DECORATION.

Roman, 3rd or 4th Century. (896-'75).

clay; but in the fourth and fifth centuries the mosaics which decorated the walls and roofs were wholly of glass.

Besides the ornamental vessels of coloured and moulded or cut glass which have been mentioned above, the Romans made a prodigious quantity of vessels of the most various forms and destined for every sort of domestic use from uncoloured glass; this has (with the exception of a very few examples, probably of late date) a slight green or yellowish tint, occasioned by the presence of small quantities of oxide of iron, from which sand is very rarely perfectly free. Horace therefore paid no extravagant compliment to the Bandusian fountain when he said that it was more bright than glass. Engravings of these may be found in numerous antiquarian works, and Mons. Deville has given many well-chosen examples, with ingenious suggestions as to uses to which they applied. Sometimes these vessels were of large dimensions: globular urns a foot high and of corresponding diameter are not unfrequently met with.

Glazed pottery was not much in use, and as the finer specimens of ornamental glass took on the table of an opulent Roman the place which porcelain does upon ours, so common glass no doubt served for many purposes for which we employ common earthenware. Glass was used in Rome in the time of Martial in such quantities that the poor, who inhabited the quarter of Rome beyond the Tiber, made a living by hawking about sulphur matches and exchanging them for broken glass. In tombs the ashes of the dead were often collected into an urn of glass, and great numbers of vases and cups and phials of the same material were placed around. The larger part of the entire vessels which are preserved in our museums has been found in sepulchres; sometimes as many as twenty or thirty vessels of various sizes and forms in a single tomb.

For one purpose the Romans employed glass much less than we do, viz. the preservation of wine, for which they used large earthen amphoræ; but they occasionally kept very choice wine in amphoræ of glass; for Petronius narrates that at Trimalchio's feast amphoræ

of glass were brought, carefully cemented, to the necks of which labels were affixed with this inscription: "Opimian Falernian an hundred years old."

There can be no doubt that glass was used by the Romans in windows, though by no means exclusively; mica, alabaster, and shells having been also used. Glass in flat pieces has been found in the ruins of Roman houses both in England and Italy, and in the house of the Faun at Pompeii a small pane in a bronze frame remains. Glass of this description seems to have been cast on a stone and is usually very uneven and full of defects, so that, although capable of transmitting light, it must have admitted of only an imperfect view of external objects. When the window openings were large, as was the case in basilicas and other public buildings and sometimes in houses, the glass was doubtless fixed in pierced slabs of marble or in frames of wood. The pieces of glass or other transparent substance so employed were, we may infer, called specula. Specularii are mentioned in an ordinance of Constantine II. A.D. 337. They probably were the glaziers of the time, working, however, in other materials as well as in glass. In the British museum is a piece of glass (No. 308 of the Slade catalogue) bent by heat, which was given to the writer by a canon of the cathedral of Treves; it was found with a large quantity of similar pieces under the walls of that church, accompanied and overlaid by such other remains as to make it tolerably certain that they were relics of the church burnt in A.D. 420, when the city was pillaged by the Franks.

Whether the Romans used glass for mirrors is a question which has been much debated. They knew that obsidian, and consequently black glass or common glass blackened on one side, would reflect images; and they had mirrors which would magnify; some large enough apparently to reflect the entire human person. But it is by no means certain of what substance these mirrors were composed. Their glass was so full of bubbles and striæ, and, so far as we know, their power of producing and polishing large sur-

faces of glass so limited, that on the whole it would appear more probable that their mirrors were metallic. A fragment of a circular plate of glass foliated with a sheet of lead is said to have been recently discovered at Lillebonne among Roman remains. The fact that mirrors could be made by the application of a coating of metal to glass was, as will be shown hereafter, known for centuries before such mirrors superseded those made of polished metal plates. To make a really good glass mirror two things are requisite: very pure glass free from bubbles and striæ, and a good method of applying the metal; and it was apparently not until the middle of the sixteenth century that both these processes were perfected. Undue stress has been laid on the passage in Pliny in which he says that the Sidonians first invented "specula," for the word may mean glass for windows and not mirrors only; and whoever looks into all the passages in Pliny's natural history in which mirrors are mentioned must be convinced that not glass but metallic mirrors were those in ordinary use. In the passage "neque est speculis aptior ulla materia" probably windows and not mirrors are alluded to.

The Romans possessed some imperfect knowledge of the use of magnifying-glasses. Seneca states that a ball of glass filled with water enlarges minutely-written letters. Perhaps lenses of glass were made, but if so it is difficult to account for Seneca's having mentioned the glass ball and not the lens; if they were not made, the reason probably is that it was difficult to procure a perfectly pure piece of glass free from bubbles or striæ, defects which of course would be fatal to the efficiency of the lens. A lens of glass or crystal is said to have been found at Nineveh, but it is altogether uncertain what was its date, as the mounds which mark the site of that city have been used as burying-places for many centuries down to comparatively modern times. Another lens is said to have been found at Pompeii, but Mr. King (in his book on gems) doubts whether this was really anything but an imitation of a gem. The passage in Pliny in which he tells us that Nero looked at the com-

bats of the gladiators in an emerald has been interpreted as a proof that the use of a lens was known to the Romans, an emerald having been fashioned into one for the use of the emperor; and as it would seem that he was short-sighted there is much probability in the supposition; but it must be observed that the passage immediately follows one in which mirrors are spoken of, and the same effect is ascribed to a flat emerald as to a mirror.

The effect of a prism in dividing the solar ray was known to Seneca, for he says that rods were made from glass drawn out or with many angles like a club with branches; so that if the sun shines through them they give the colours of the rainbow.

The curious anecdote about malleable glass which has been told by Pliny and by Petronius Arbiter should not perhaps be passed over without mention, whatever importance we may think proper to attach to it.

The story, as given by Trimalchio at his banquet, runs as follows: "There was once an artist made glass vessels of such a firmness that you would no more break them than gold or silver. This person having made a cup of the finest crystal, and such an one as he thought worthy none but Cæsar, got admission with his present. The beauty of the gift and the hand of the workman were highly commended, and the zeal of the donor kindly received. When the man, that he might change the admiration of the court into astonishment and ingratiate himself still more in the favour of the emperor, begged the cup out of Cæsar's hand and dashed it against the pavement with such vehemence that the most solid and constant metal could not escape unhurt, Cæsar was both surprised and troubled at the action; but the other snatching the cup from the ground, which was not broke but only a little bulged as if the substance of metal had assumed the likeness of glass, drew a hammer out of his bosom and very dexterously beat out the bruise, as if he had been hammering a brass kettle. And now the fellow was wrapt in the third heaven, having as he imagined got the friendship of Cæsar and the admiration of all the world; but it

happened quite contrary to his expectation; for Cæsar asking him if any one knew how to make glass malleable besides himself, and he answering in the negative, the emperor commanded his head to be struck off; for, said he, if this art be once propagated, gold and silver will be of no more value than dirt." Pliny tells substantially the same story, naming Tiberius as the emperor; but says that the artist's workshop and tools were destroyed, not that he was put to death.

It is probable that these tales originated from an exaggerated report of a discovery of a process by which the brittleness of glass was much diminished, as is the case by that of annealing in oil which has lately excited a good deal of attention.

We have very little positive knowledge of the state of the art of glass making at Rome during the ages which witnessed and followed the decline and fall of the empire: whatever vessels may have been produced by the workshops were no doubt made by the same processes as those of earlier times, and are probably scarcely distinguishable from them except by imperfection of manufacture. A considerable quantity of glass was, however, made for mosaics: of these decorations there is a series at Rome, ranging from the time of Constantine until after that of Charlemagne, chiefly or entirely composed of glass. Fine examples of the fifth and sixth centuries exist at Ravenna, and there would seem to be no good ground for supposing that the material was imported and not made on the spot.

The making of glass for windows was, it would appear, continued throughout the dark and middle ages; its use for this purpose is alluded to by Lactantius in the fourth century, St. Jerome early in the fifth, and Gregory of Tours and Fortunatus in the sixth. The windows were formed of slabs of marble, or sometimes of hard stucco, in which were openings of various forms and of moderate size in which the plates of glass were fixed. Though many of these slabs still exist at Rome, and in one instance, viz. at St. Prassede, portions of the talc with which the apertures were filled adhere to

their sides, no glass remains which can be attributed to a very early date. At St. Sophia, where the ancient method of glazing has been preserved, some of the plates of glass, 7 to 8 inches wide, and 9 to 10 inches high, which seem to have been not blown but cast, may perhaps date from the building of the church by Justinian.

The use of coloured glass in windows does not appear to be mentioned before the instance in the Lib. pontif. where Leo III. is said to have decorated the windows of St. Peter's and the Lateran with glass of divers colours; but it is probable that it was a very early practice.

CHAPTER IV.

Glass in Byzantium and in countries of the East.

As the splendour and wealth of Rome declined many artificers of course emigrated to Byzantium, and, whether the art was practised there in the time of Constantine or not, there can be no doubt but that in later ages it was carried on to a very great extent: one of the gates leading to the port took its name from the adjacent quarter in which the glass houses were situated. Glass was also made at Thessalonica. St. Sophia's when built by Justinian had its windows filled with glass, some of which (as has been said above) may perhaps even now remain; and glass was largely used for works in mosaic, and probably made, or at least remelted and coloured, on the spot; for at the commencement of the eighth century, when peace was made between the caliph Walid and the emperor Justinian II., the former stipulated for a quantity of mosaic for the decoration of the new mosque at Damascus. In the middle of the tenth century the emperor Romanus II. sent to the caliph Abderrahman III. the materials for the mosaics of the Kibla in the mosque at Cordova.

We know very little, scarcely anything, of the products of the Byzantine workshops as regards vessels or ornamental works in glass; but it is not improbable that some of the cups or vases which bear the character of classical art in its decline, such as the situlæ in the treasury of St. Mark at Venice, and two specimens in the British museum (Nos. 320 and 321) may have been made at Constantinople; for we may reasonably suppose that this branch

of art underwent somewhat the same vicissitudes which befell the arts of painting and sculpture in the eastern empire. The Byzantine painters and sculptors seem to have followed classical models with more or less bad taste and feebleness, until the fervour of the iconoclastic emperors brought about a temporary paralysis of all art and the emigration of many artists. When in the middle of the ninth century the arts were again more largely practised ancient traditions had in a great measure been lost, and the new style which we know as Byzantine, into which the older had previously been in some degree merging, became almost exclusively prevalent. Something of the same kind probably happened as regards the manufacture of glass, but examples which we can confidently assign to the post-iconoclastic period are nearly wholly wanting. Almost the only objects which have come under the notice of the writer, and which there is good ground for supposing to belong to the centuries intervening between A.D. 800 and A.D. 1200, are some in the treasury of St. Mark's at Venice: these differing much in character from any other kind of glass productions, and in some cases bearing Greek inscriptions on their mountings, are probably specimens of Byzantine work. They are believed, together with many other objects in the same treasury, to have been part of the plunder of Constantinople when it was taken by the crusaders in A.D. 1204. Five are cups and two are shallow basins; the glass in all is greenish, very thick and with many small bubbles; all have been cut with the wheel. One of the cups, 12 inches wide and 6 high, is of a somewhat elegant form; it has two handles but is otherwise without ornament. Another cup has the surface so cut away that small cones are left standing up, and another has circles formed in the same manner; a third has a very rude figure of a leopard couchant, with outlines and spots standing up in the like fashion.

The basins are shallow, about 11 inches wide; one has a setting of gems in silver gilt, and a long handle; the other has circles and cones in projecting lines on its under-side, and a setting in silver gilt, with the inscription: ✠ ΑΓΙΕ ΠΑΝΤΕΛΕΗΜΟΝ ΒΟΗΘΕΙ ΤΩ CΩ

ΔΟΥΛΩ ΖΑΧΑΡΙΑ ΑΡΧΕΠΙCΚΩΠΩ ΙΒΗΡΙ ΑΜΗΝ, *i.e.*, "Saint Panteleon, protect thy servant Zacharias, archbishop of Iberia, Amen." The most remarkable, however, among these glass vessels is a small vase, $3\frac{1}{2}$ inches high by 4 wide, of very dark brown glass almost opaque; the body is somewhat globular, and the mouth widens upwards. The body is decorated with seven circles enclosing figures which are painted on the surface in a pale flesh-coloured enamel, with ornaments in gold and in red. These figures are evidently free copies of antique originals, and are closely allied in point of style to the ivory boxes of Byzantine origin with mythological subjects which may be seen in various collections and church treasuries. Some of the figures are clothed and some nude; one seems to represent Jupiter seated on a throne, and addressed by a figure with wings, probably intended to represent Mercury; another figure holds a trident. The circles are composed of rosettes of blue, green, and red enamel, each surrounded by lines of gold. Above and below the points of junction of the circles are smaller circles of gold enclosing busts of men, with bands of gold in the hair. On the outer side of the mouth are rosettes in groups of four, with scroll-like flourishes in gold between the groups. An inscription in Cufic characters runs round the inside of the mouth, and another round the lower part of the body below the figures. No reading of these inscriptions has as yet been obtained, and it seems probable that they are merely ornamental and without sense. In the character of the figures and the manner in which they are drawn, in the rosettes, and in the busts within medallions, there is so close a similarity to the ivory boxes before mentioned that we may assume them all to have had a common origin; and this (it is evident) must have been at some place where works of antique art were familiar objects. The only point of dissimilarity is the presence of Cufic inscriptions, which have never been met with on the boxes in question, and which may perhaps point to Sicily, one of the countries where antique, Byzantine, and Arab art met. The ivory boxes with mythological subjects were made chiefly in

the eleventh and twelfth centuries, the best period of the Byzantine post-iconoclastic art.

The famous table of emerald, part of the booty of Toledo when taken by Tarik in 711, should be mentioned. It is thus described by El Makkari, as translated by don Pascual de Gayangos. "It was there (*i.e.* at Toledo) that Tarik, son of Zeyad, found the table of Suleyman. The table was made out of one solid emerald, and when presented by Musa to the khalif Al-Walid was valued at one hundred thousand dinars." Another account states that it was inlaid with precious stones of various kinds and hues, as well as with aromatic woods, that it was ornamented with several inscriptions in the Greek tongue, and that it was made of a solid piece of emerald; also that it had three golden feet. El Makkari in another passage quotes Ibn Tayyan as describing the table as of pure gold, set with precious stones, and says that it was found on the altar of the principal church at Toledo, in which city it is said to have been made. According to some writers it had 365 feet, according to others four, or three, or none. It was probably either the frontal of the altar or a super-altar, and the "emerald" a large slab of Byzantine glass. If it be true that the table bore Greek inscriptions it was no doubt the work of Byzantine artists.

Another vessel which is in all probability Byzantine is the cup in the church of St. Adalbert at Cracow, and which is said to have been the chalice of that saint (*ob.* 997); it is of variegated glass, very massive, and out of its thickness figures of eagles and lions have been carved in a very stiff style. At the abbey of Reichenau, on an island in the lake of Constance, is (or was) preserved a slab of transparent green glass, which all through the middle ages passed as an emerald; it was 2 feet wide by 13 inches high, and 3 inches thick. According to tradition it was sent with several others to Charlemagne by Irene, mother of the emperor Constantine VII. Keysler, who travelled in 1730, writes of it as being really an emerald, and gives an amusing account of the precautions taken by the prior for its safe keeping.

A fragment of a glass vessel in the British museum may very possibly be of Byzantine origin; it is very massive, of an opaque turquoise blue, and has been ornamented with enamel painting in lines of red and gold.

Theophilus tells us that the Greeks ornamented cups by means of gold leaf enclosed within the substance of the glass, and that they decorated cups and flasks of various colours with lines and net-work of white or other coloured glass threads. M. Labarte observes that the process described by Theophilus differs from that by which the glass vessels ornamented with gold leaf, found in the catacombs, were made; the first being the application of glass ground into powder, applied in the form of a paste and then fused in the furnace, while in the early Christian vessels the protecting film was applied in the form of a leaf of glass. But do we know what process was really used by the manufacturers of the fifth and sixth centuries?

The art of making glass cameos by pressure in a mould was practised among the Byzantines, and examples are not uncommon in museums. The specimens are more ordinarily opaque red, and do not generally appear to be very early in date. Another variety consists of medallions or counters of light green glass, probably used as test weights for coins. Examples are in the British museum.

The well-known Sacro Catino at Genoa, a shallow dish with a foot and handles, long supposed to have been formed out of a single emerald, is more probably of Byzantine than of antique origin. It is hexagonal rather clumsily formed, with some slight ornament, and has apparently been finished with a tool. The colour is very fine, but it contains many small bubbles. It was part of the booty obtained at the taking of Cæsarea in 1101. The cup at Monza, said to have belonged to queen Theodolinda (A.D. 600), and to be hollowed out of a sapphire, is perhaps also glass; although the writer failed to detect any bubble on a very close inspection, and it is cold to the touch. It is of a very beautiful blue, and about three inches in diameter.

It is difficult to find any mention of Byzantine glass-working during the latter middle ages, but Clavijo, in the narrative of his embassy to Timour Beg in 1403—1406, states that in the church of St. John Baptist at Constantinople were many lamps of glass.

Our information is but scanty as to the manufacture of glass in that part of the east which was not included in the Byzantine empire, or which early fell under the dominion of the successors of Mahomet. A most remarkable illustration of Persian work may be found in the cup of Chosroes I. (A.D. 531—579), preserved in the bibliothèque Nationale at Paris. It is a very shallow bowl of gold in which are set a central medallion of rock crystal sculptured with an effigy of the king and three rows of medallions, white and crimson alternately, ornamented with rosettes in relief; of these the white are of crystal and the crimson of glass. Between these medallions are lozenges of green glass. Both medallions and lozenges are transparent and set clear. The rosettes on the crimson medallions have been formed by casting or pressing the glass into moulds.

Little can be learnt from existing specimens respecting the manufacture of glass in the east from this period until the thirteenth century, but that glass was made in several countries under the Arab rule is proved by the coins, or weights, or tokens of glass which are occasionally found, and which are usually inscribed with the names of Fatimite caliphs of Egypt in Cufic characters: one of these, brought from upper Egypt, was inscribed, "by order of Obeyd Allah, son of Alkhebkhab, this has the value of a feston or twenty kharouba of weight." Another at Paris bears the name of Al-Mo'izz, who reigned in Egypt from A.D. 952 to A.D. 975. Three examples in the South Kensington collection, Nos. 474. '75, 475. '75, and 476. '75, bear the names of a certain Omar, the Fatimite caliph El Mostanser Billah, A.D. 1035 to 1094, and El Hakim, A.D. 996 to 1020. Glass must have been well known in the east in the seventh century, for in the Koran may be found the legend how Solomon deceived the queen of Sheba by paving part of his hall

with glass. Glass is mentioned again in another passage: "Vessels of silver and goblets of glass shall be borne round among them; glass bottles like silver, whose measure themselves shall mete."

The art of glass making, although not wholly unknown, would seem to have been but little practised in the various parts of the east subject to the Mahomedan rule until after the year 1000; for (as has been said before) at the commencement of the eighth century, when peace was made between the caliph Walid and the emperor Justinian II. the former stipulated for a quantity of mosaic for the decoration of the new mosque at Damascus. In the middle of the tenth century, the emperor Romanus II. sent to the caliph Abderrahman III. the materials for the mosaics of the Kibla in the mosque at Cordova.

A curious passage in the Safarnamah of Nasir Ibn Khursu (published by the royal Asiatic society), who visited Jerusalem about 1060, shows that glass making in Syria was at that time more advanced than might perhaps have been expected. He states that in the church in that city called Beytu-l-makamah "Portraits of Jesus represented as sitting on an ass are put up in several places, as well as those of the other prophets, such as Abraham, Ishmael, Isaac, Jacob, and his children (on all of whom be peace), and they are anointed with oil of sindarus. Each picture, moreover, is covered with a large plate of transparent glass of the same size as itself, so that the picture may not be at all hidden, and this they place there to prevent the dust from settling on the painting, the glasses being daily cleaned by servants."

In the twelfth century we find from the travels of Benjamin of Tudela (circa 1163) that the making of glass was practised by the Jews at Antioch, where were ten glass manufacturers of that nation, and at New Sur, where were four hundred Jews, "shipowners and manufacturers of the celebrated Tyrian glass." He also tells us that it was said that one wall of the great mosque at Damascus was formed of glass by the magi, and that there were in it "as many openings as there are days in the solar year, and that the

sun in gradual succession throws its light into the openings, which are divided into twelve degrees." He also states that the shah of Persia, Sinjar (1140—1157), had caused the body of the prophet Daniel to be placed in a coffin of glass at Susa. We have, unfortunately, no description of the kind of glass then made in Syria, nor have any examples been observed which can be assigned with certainty to the twelfth or any earlier century. In the treasury of St. Mark's at Venice there is a remarkable vessel of glass which is of oriental fabrication and probably of early date. It is 8½ inches wide by 4 inches deep, of a turquoise green paste, nearly opaque. On the bottom are four Arabic characters signifying, according to Montfaucon, "God the Maker." The bowl is five-sided, and on each side is a rude figure of a hare. These figures, as well as the inscription, are in low relief, and were probably cut with the wheel. The setting is of filigree, with stones and ornaments of cloisonné enamels. There is a tradition that it was a present from a king of Persia in 1470, but the setting is of a much earlier character and not Persian in style.

There are, however, examples which may be safely attributed to the thirteenth century, and particularly a basin and a large bottle belonging to baron Lionel de Rothschild; round the latter of these is an Arabic inscription, containing the name of El-Melek El-Ashraf, a name borne by several sultans of Egypt and Syria in the thirteenth century. M. Labarte mentions a shallow basin in the musée de Cluny, as bearing the titles of Malek Adhel, who reigned in Egypt from A.D. 1279 to A.D. 1294.

There is little difference in character between this and examples belonging to the next century made in Egypt. All show that the makers were tolerably expert glass-blowers and could produce vessels of considerable size; but the glass is bad in colour and full of bubbles and imperfections. The makers had learnt, probably from the Byzantines, the art of gilding and enamelling glass, and made much use of it. Inscriptions in large characters are favourite ornaments; figures of birds, animals, sphinxes, and other monsters

are found. The outlines are generally put on in red enamel, the spaces between being often gilt. The enamels are used sometimes as grounds and sometimes for the ornaments; the usual colours are blue, green, yellow, red, pale red, and white.

Enamelled Oriental bottle and lamp.

Among the products of the oriental glass works may be particularly noticed the enamelled lamps which were suspended in the mosques, especially in the fourteenth century. Lamps of this kind are still to be found in the mosque of sultan Hassan (1347-61) at Cairo. A specimen, bearing the name of the emir Sheikhoo who built a mosque at Cairo in 1355, is in the British museum. Three very good specimens of lamps doubtless of Egyptian manufacture are in the South Kensington collection, all dating from the fourteenth century. They possess additional interest, as they bear the

names of the persons who either made or decorated them. The artist in two examples designates himself as "rashim"; a word which, like many other Arabic words, is capable of many interpretations. The primary sense would seem to be "one who marks;" here it probably is to be explained, one who paints or writes. That the name of the decorator rather than that of the glass maker or blower should be thus commemorated is very easily to be understood. No peculiar skill was required to produce the vessel, for as is the case with other similar oriental objects neither the material nor the workmanship is good, and the merit is wholly in the decoration. Two of the three examples (Nos. 1056. '69. and 581. '75.) would appear to date from the earlier, and one (No. 6820. '60.) from the latter half of the fourteenth century.

In the Slade collection in the British museum, besides the lamp above noticed, may be remarked a bottle of peculiar and elegant form, diapered over with birds (No. 334), and a covered bowl of ancient though less rich workmanship (No. 335) probably of Egyptian origin.

Vessels thus enamelled were brought into western Europe and evidently much esteemed, for we find them mentioned in the royal inventories of France. In 1380 Charles V. had "trois pots de voirre rouge à la façon de Damas. Un petit voirre ouvré par dehors à images à la façon de Damas. Un bacin plat de voirre peint à façon de Damas, et une bordure d'argent esmaillée de France et de Bourgogne. Une lampe de voirre ouvrée en façon de Damas sans aucune garnison." In 1399, "Une coupe de voirre peint à la Morisque." Henry III. of England had a glass cup which was presented to him by Guy de Roussillon, and caused it to be set with a handle and foot of silver. This may have been a glass of eastern origin. Henry IV. had a little vessel or pot for "theriacum" of silver gilt, with a glass of Alexandria.

We may see from the above, and many like cases, that Damascus was supposed in the west to be a chief seat of this manufacture, and an additional proof that it was really so is supplied by what we

are told by Clavijo, in the narrative already quoted, that in 1402 the conqueror carried off from Damascus to Samarcand "weavers of silk, men who made bows, glass, and earthenware, so that of these articles Samarcand produces the best in the world." The same writer says that at Timour's banquets, in the camp at Samarcand, meat was served "in basins of gold, silver, earthenware, glass, and porcelain."

A few examples of this manufacture have been preserved in the west from an early date, and deserve mention; one of which is the cup in the museum of the university of Breslau, said to have belonged to St. Elizabeth queen of Hungary who died in 1231. This is a drinking cup without a foot, of moderate size, and its only ornaments are lines of red enamel forming arabesque patterns. Another is the so-called "Verre de Charlemagne" formerly in the abbey of Chateaudun, now in the museum of Chartres; it has Arabic inscriptions. The "Luck of Edenhall" an elegantly enamelled cup, somewhat oriental in pattern but without inscriptions, is, we think, of a like origin. It is preserved in the family of Musgrave, and is enclosed in a stamped leathern case of the fifteenth century. Another specimen, also with a case of the fifteenth century, is kept in the museum at Douai. Two good examples are at Vienna in the treasury of the cathedral, where they have been since the fourteenth century.

The sack of Damascus by Timour Beg's army and the carrying away of the workers in glass no doubt injuriously affected glass making in that city, and the superiority of the Venetian manufacture, then fast rising to the excellence which it eventually attained, probably assisted in bringing about the decay of the art. We hear little from travellers in the east from henceforth about the making of glass, nor do our collections seem to contain examples of eastern manufacture of the fifteenth or sixteenth centuries. An exception, perhaps, is a bottle with a long neck on which are inscriptions in gold on a blue ground, and figures of dancing girls enamelled in various colours. This is, perhaps, Persian, and is certainly later

than the fourteenth century; a few years since it belonged to the princess Eleonora Corsini, at Florence. A very elegant vase is in possession of the marchese Alfieri, at Turin; of blue glass, about a foot high, enamelled with inscriptions, birds, and other ornaments; it is in a beautiful silver mounting of the fifteenth century, with German inscriptions, and may perhaps be not much earlier in date than the mounting.

If we can place faith in the Mahawanso (the chronicle of the Singhalese kings) "mirrors of glittering glass were carried in procession, B.C. 306," and festoons of beads like gems, probably glass beads. About the same date "windows, with ornaments like jewels which were as bright as eyes," are also mentioned in the Mahawanso: this phrase would seem to indicate windows like those formerly in use in Europe, and more recently in the east, in which small pieces of glass coloured or uncoloured are fixed into frames of marble, stone, or stucco so perforated as to form patterns. The Hindus have been long aware that glass is a non-conductor of electricity, and placed lumps of it on the tops of their temples as a protection against lightning. Admiral Fitzroy states that "in Japan, China, Siam, Ceylon, and other eastern countries, a system has prevailed from time immemorial of placing lumps of glass on the pinnacles or other high points of building to avert lightning." An obscure passage in the Mahawanso, under A.D. 241, seems to refer to this practice; it runs thus: "Having placed a large gem on the top, he fixed below it for the purpose of averting lightning a vajira chumbata like a ring." Turner, who translated the Mahawanso, has rendered "vajira" by glass, but it is doubted whether it may not mean a loadstone or an iron magnet. However this may be, these passages from the chronicle would appear to furnish ground for a confirmation of the belief that the making of glass in the further east has been earlier in date and more important in practice than has been usually supposed. The whole matter certainly deserves closer examination than it has yet received.

Pliny tells us that the Indian glass was the finest, being made

from crystal, but no examples seem as yet to have been carefully examined which have been well ascertained to be of Indian origin. In the tope at Manikyala in the Punjab, opened by general Cuningham, which appears to date from about the Christian era, was found a glass-stoppered vessel, and similar vessels or fragments have been discovered in other topes of a later date. The fragments of glass in the British museum found at Brahminabad are hardly distinguishable in character from Roman glass. Dr. Birdwood, of the Indian museum, has suggested that the Indian glass which Pliny mentions was really Chinese. In the time of Pliny no doubt articles of Chinese origin might, and probably at Rome would, be called Indian, and the supposition is strengthened by the fact that the Chinese would seem to use quartz rock at the present day in the making of glass in the province of Shan-tung. The Indian enamellers now use cakes of glass or enamel imported from China, and as yet India has yielded few traces of the manufacture of glass within its borders. Sir John Hawkins (in Purchas's "Pilgrimes") indeed says in his description of the treasures of the emperor Jehangire in 1608 that "of rich glasses there be two hundred," but he gives us no hint as to their character: they may have been Persian, or Chinese, or even Venetian. The latter were frequently carried by the navigators of the sixteenth century in their voyages to the east.

In the seventeenth century we again meet with a peculiar and characteristic kind of glass in Persia, blue with gold ornaments, of which No. 343 in the catalogue of the Slade collection in the British museum is an example. Chardin, who was in Persia between 1664 and 1667, tells us that the windows of the tomb of shah Abbas II. (*ob.* 1666) at Kom were "de cristal peint d'or et d'azur," and these vases may therefore very probably be of that period. He describes bottles as being cut, some diamond-wise, others "à gaudrons," and others as painted; and it would appear from the context that the bottles were of Venetian origin, but he does not make his meaning quite clear. Mirrors and "belles bouteilles à prendre du tabaq"

probably the water-holders of narghilehs, were, he tells us, brought from Venice.

Chardin says that the ordinary glass made at that time in Persia was of bad colour and very imperfect manufacture; this he attributes to the badness of the fuel which the makers employed, and to the fire not being maintained more than three or four days; the best glass, he says, was made at Shiraz. The manufacture had then existed for only about eighty years, having been introduced by a necessitous Italian; from that time to the present glass has, it would appear, been made in Persia in the same forms and of the same quality. Several specimens (as Nos. 2423 to 2431.—'76) of vessels have been lately added to the South Kensington collection which are stated on good authority to be exactly similar to those made daily in Persia; some of these correspond in form to a bottle shown in Chardin's engraving of the interior of the shah's drinking-hall at Ispahan, while in texture and quality of material they differ little from Venetian glass of the sixteenth or seventeenth centuries.

Glass was also manufactured in the seventeenth century at Smyrna; for Grelot mentions glass making among the trades practised in that city: he travelled about 1680.

CHAPTER V.

Glass in Italy.

Not much has as yet been ascertained respecting the making of glass in Italy during the dark and earlier middle ages; and the history of even the Venetian manufacture does not begin at a very early date. During the fifth and sixth centuries many and large churches were built at Rome and at Ravenna, which were filled with immense windows, and largely adorned with mosaics; it seems probable, therefore, that glass was made, or at least coloured, in both cities. In Rome, mosaic was largely used down to the ninth century.

In the eleventh century we find that Desiderius, abbot of monte Cassino (afterwards pope under the name of Victor III.), sent to Constantinople for workers in mosaic; and this fact, coupled with the absence of mosaics of that period at Rome and elsewhere in Italy excepting Venice, seems to indicate that the manufacture was then little practised in that country. In the twelfth and thirteenth centuries mosaic work was much used in central Italy in the decoration of monuments, tabernacles, and the like, where it was inlaid in white marble. In Rome, where the family of the Cosmati have left many monuments of their skill, it is not uncommon to find such a decoration composed partly of pieces of antique glass and partly of the manufacture of the time. It is scarcely likely that all the glass was brought from Constantinople, or even from Venice.

That a knowledge of the art of making both plain and coloured

glass was pretty widely diffused throughout Europe, from a period at least as early as the twelfth century, is shown by the treatises of Eraclius and Theophilus, where we find directions for making glass vessels as well as window glass, and for the production of several varieties of plain and coloured glass. The first of these writers was, it is supposed, an Italian who lived previous to the twelfth century; but the work, as we now have it, seems to have been added to by an inhabitant of the northern part of France in or before the thirteenth century. Theophilus would appear to have written in Germany, and not earlier than the twelfth century. In these treatises a distinction is made between ordinary and Roman glass; and in one passage of Eraclius Jewish glass is mentioned. By Roman it is clear that ancient Roman not Byzantine is meant, and it is directed to be employed for glazing earthen vessels and for making artificial gems. Jewish glass is to be used for painting on glass, and was suited to the purpose as containing lead and therefore more fusible. In the seventh chapter of the third book of Eraclius are full details as to the making of glass, in which process two parts of fern ashes and one of the ashes of brushwood are to be employed.

Eraclius describes the method of ornamenting vessels with gold in the same manner as those found in the catacombs at Rome, but he speaks of it not as an art then practised or having come down by tradition but as being re-discovered by himself. Theophilus, on the other hand, describes various processes of this ornamentation as being actually practised by the Greeks in his day. In each of these works directions for making both window glass and vessels are given; but the latter branch of the art was apparently not practised in Europe during the middle ages with any considerable success excepting, as we shall see, in Venice.

Vessels of glass of European fabrication although doubtless made and used for certain purposes, especially perhaps for medical uses, do not seem to have been in general use, nor were they so decorated as to make them objects of luxury, and accordingly they are rarely noticed in inventories.

If glass for windows was made in many parts of Italy the other chief branches of glass manufacture, viz. of mosaic, of vessels, and of personal ornaments, were still more extensively practised at Venice. It has been asked, What was the origin of this manufacture? The native writers have been disposed to think that it was brought to the lagunes by the refugees from the mainland in the fifth century; and others, that it was chiefly or entirely learnt from the Greeks of Byzantium at a much later date. Both monumental and documentary evidence are almost entirely wanting as regards any period antecedent to the thirteenth century, with the exception of the mosaics in the churches of Murano, Torcello, and St. Mark, the earliest of which are those of the church of St. Cyprian at Murano, completed in A.D. 882. We have no evidence whether these were the work of native or of Byzantine artists; but the fact (already mentioned) that in the eleventh century Desiderius sent not to Venice but to Constantinople for workers in mosaic indicates that the reputation of Venice in that branch of art was at that time not great.

The argument in favour of the early existence of the art of glass making at Venice, and its traditional derivation from Roman workmen deduced from the similarity of processes and colour between the Venetian work of the sixteenth century and that of the first and following centuries at Rome, loses much of its apparent force, when it is remembered that the earliest products of the Venetian glass-houses with which we are acquainted bear a different character; and that the processes in question, such as those of making mille fiori and vitro di trina (so far as we know), first came into operation at the time when all relics of ancient art were carefully collected, and reverently studied and copied.

Signor Cecchetti remarks that in the documents of the eleventh and twelfth centuries, preserved in the Venetian archives, no mention occurs of glass or of glass-workers with one exception, that of Petrus Flavianus or Flabanicus (hereafter mentioned); and he evidently holds the opinion that until the thirteenth century the art

was not practised on a large scale. He does not assert that it was altogether lost during the earlier centuries of the existence of Venice, nor does it appear probable that this should have been the case. For we must remember that it seems certain that in France, Germany, Spain, and (possibly) even in England some knowledge of the art was preserved through the dark ages, making it unlikely that it should have perished in that archipelago, where the barbarian invaders of the Roman empire never established their rule, where commerce continued to flourish, and where consequently the traditions of ancient luxury must have been better preserved than in almost any other place. The manufacture of glass was not carried on as now in large establishments but by artizans working on a small scale, and it is hardly likely that among the refugees from cities so large as Padua, Aquileia, and others, none were able to produce articles of such constant use in everyday life as were those formed of glass in the later days of Roman civilization.

It is highly probable that the vast undertaking of covering the interior of St. Mark's church with mosaic had a most important effect upon the supply of glass in Venice; for if the manufacture already existed it would unquestionably receive a great impulse; if it did not exist, the presence of Byzantine artists and workmen skilled in such matters would lead in the most natural manner to the discovery that the lagunes, possessing abundance both of fine sand and of maritime plants yielding alkali, were well fitted for the seat of a manufactory of glass.

The names of the earliest artists in mosaic who worked at St. Mark's have not been preserved, but in the year 1159 one Pietro was so employed. The earliest positive evidence of the existence at Venice of a worker in glass would seem to be the mention in the year 1090 of a certain Petrus Flavianus, phiolarius, in the ducale of Vitale Falier in the archives at Venice. In 1204 the taking of Constantinople must have afforded the Venetians an opportunity of acquiring additional knowledge of the processes employed by the Greek glass makers. In 1224 as many as twenty-

nine persons are mentioned as "friolari" (*i.e.*, phiolari), who had infringed the regulations laid down by the officials of the "ars friolaria." This proves that by that time the art had become one of considerable magnitude. Distinct documentary evidence on the organization of the glass manufacture of Venice begins in the thirteenth century, and the earliest portions of the "mariegole" (*i.e.*, madreregole) or codes of trade regulations of the various sections of glass workers would appear to have been drawn up about the middle of that century. On the other hand, one regulation in the mariegola dei phioleri de Muran is said by Zanetti to bear as early a date as 1180. Several of these "mariegole" are still preserved in the libraries or archives of Venice and Murano, but they are generally incomplete or mutilated.

The "Arte Vetraria" may, according to signor Cecchetti, be divided into six branches: that of the "fialai" or "fioleri" (makers of vessels), the "verieri" or "fornafieri" (makers of glass in mass), the "cristallai" (makers of glasses for spectacles), the "specchiai" (makers of mirrors), the "margaritai" (makers of small beads), the "perlai" (makers of large and hollow beads), and the "venditori" or "stazioneri" (dealers in glass wares). The last of these classes does not come within the scope of these notices, and what has to be said respecting Venetian glass making may be conveniently divided into the sections, 1st, of vessels and window glass; 2nd, of optical glasses; 3rd, of mirrors; and 4th, of beads.

When the branches of the art became well defined the masters and workmen exercising each kind of industry formed themselves into distinct bodies with special regulations set forth in their several "mariegole." The "fioleri" (as has been noted already) were in the thirteenth century a considerable body, and must have produced a large quantity of wares. We are told by the chronicler Martino da Canale that in 1268, at the time of the election of the doge Lorenzo Tiepolo, they exhibited "guastade" (decanters), "oricanni" (scent-bottles), and similar pretty objects; and in 1279 they made measures and weights of glass, as is mentioned in a

decree of the great council of that year. In 1275 a law was enacted prohibiting the exportation of the sand and other substances used in making glass, and also of the fragments of broken glass. Several other decrees were made in the course of the thirteenth century by the same authority respecting the making of glass; one of these, of the year 1279, mentions German hawkers or pedlars of glass.

On the 8th November 1291 it was ordered by the great council that the glass furnaces should be demolished in the "Città di Rialto" (that is, what is now called the city of Venice) and throughout the whole "diocesi;" and any reconstructions were to take place outside those limits, but nevertheless within the district of Venice (distretto delle Venezie). On the 11th August 1292 the severity of this regulation was mitigated by permission being granted to the makers of small glass wares (verixelli) to remain even in Rialto, provided a space of fifteen paces were left between the workshops and the houses. These regulations were, of course, to guard against the danger of fire. It is generally believed that the glass makers then carried their establishments to Murano, although there is some reason to think that the manufacture had been practised there at least as early as 1255; one Spinabello "fiolario" being spoken of as "giudice" of Murano in 1285.

The import of glass vessels from Venice into the northern parts of Europe we may conclude was not begun so early as the thirteenth century, for the only glass wares mentioned in the full and copious tariff for goods imported at Damm the port of Bruges, enacted in 1252, are rings of glass: "Vas annulorum vitreorum vel cista, quatuor denarios." Lanterns for galleys and lighthouses were made at this period at Venice: one of the former in 1289, and a lantern for the lighthouse at Ancona in 1305.

In 1295 the great council renewed the prohibition of the year 1275 against the exportation of the materials of glass, and increased the fines to be levied upon glass makers who should return to Venice after a sojourn in other states. We learn from a petition presented

on this occasion that furnaces had been established in Treviso, Vicenza, Padua, Mantua, Ferrara, Ravenna, and Bologna.

No vessels which can be attributed to the thirteenth or fourteenth centuries have as yet been noticed or described; but something may probably be learnt as to their character by careful examination of pictures of those periods. In a picture of the Last Supper, which formed part of the Campana collection, several vessels of glass were noticed by the writer: one was a bottle, of simple but elegant form, standing on a foot, ornamented by spiral lines winding round it; another was a small covered cup, standing on three balls. This picture was attributed to Margaritone of Arezzo (1212—1289), perhaps erroneously but it appeared to be at least as early as the fourteenth century.

Glass painting for windows was carried on at Venice during the fourteenth century. In 1317 one Giovanni "fioler di Murano" received from the great council a privilege to make coloured glass for windows as being superior in that art to any other; in 1335 mæstro Marco painted windows for a chapel in the church of the Frari; in 1400 Tommasino d'Axandrii and in 1404 one Nicolo went to Milan to work on the windows of the duomo.

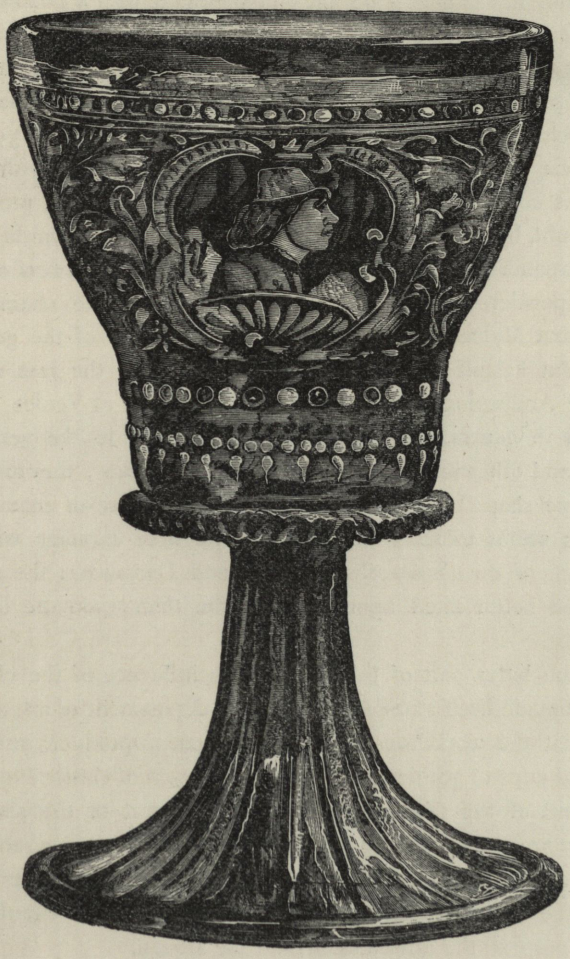
The estimation to which the art of glass making had already attained is shown by some of the decrees of the senate in the fourteenth century. On the 22nd December 1376 it was enacted that the marriage of a noble with the daughter of a "vetrajo" should not impede the descent of nobility to the offspring, and on the 15th March 1383 a set of regulations was published with the view (as is expressed in the preamble) "ut ars tam nobilis stet et permaneat in loco Muriani." Nor were this esteem and admiration of the art confined to Venice, for we find Bertrendon de la Brocquière, who travelled to the holy land in 1432, mentioning Murano as renowned for its manufactories of glasss. On September 17th 1399 letters patent were issued by Richard II. in favour of Andrea Zane and Jacopo Dandolo, masters of two Venetian galleys then in the port of London, which include a permission for the passengers to sell

their small wares on the decks of the galleys, namely, glass vessels and earthenware plates, duty free.

In 1441 the statutes of the "phioleri," the chief corporation or fraternity of the workers in glass, were made or revised, and the original is preserved in the Correr library at Venice. The making of windows and of vessels, as has been said, were the departments of the art which belonged to this corporation, and much energy and skill appear to have been displayed by its members during this century. Among the most distinguished of the company were Don Paolo Godi of Pergola and his apprentice Angelo Beroviero; the latter, in the first half of the fifteenth century, had a well-known glass-house in Murano, distinguished by the sign of the Angel. An apprentice of this Angelo, one Giorgio nicknamed il Ballerino, is traditionally said to have found the means of copying the receipt-book of his master, and to have sold the secrets he so obtained to another "vetrajo," and thus to have gained the means of establishing himself in the same manufacture; he became the head of the house of the Ballerini. Marino Beroviero, son of Angelo, was "gastaldo" (president, or as we should say, master) of the company of phioleri in 1468, and appears to have fully maintained the reputation of his father's furnace. Signor Lazari thinks that to this family the vast progress which the art made during the fifteenth century in Venice may be in large part ascribed. Other members of both families greatly distinguished themselves as glass makers during the fifteenth and sixteenth centuries; and both, as well as that of Miotti and several other of the ancient families connected with the art, are still represented in Murano. A youthful member of the Berovier family is now in the employment of Salviati & Co. at Murano, and promises to attain great proficiency in the art.

The earliest examples of the skill of Murano which are still preserved belong, it would appear, to the fifteenth century. A specimen in the Correr museum at Venice is ascribed by signor Lazari to about the year 1440. It is a cup of blue glass enamelled and gilt; the chief subjects are portraits of a young

man and woman in medallions, and it may very probably be a



Venetian enamelled glass: South Kensington museum.

"coppa nuziale" or marriage cup. No. 409.—'54 in the South Kensington museum (of which we give a woodcut) is an example

of the same kind, but the glass is emerald green: we may attribute it to the latter part of the fifteenth century. In the British museum is a cup of blue glass ornamented with a procession of figures representing a triumph of Venus, and other subjects. Other examples are somewhat less elaborately ornamented; a scale pattern executed in several colours, somewhat resembling peacock's feathers, is not uncommon (as No. 5492.—'59), and portions, such as the projecting ribs of a cup, are gilt with a very elegant effect. A sprinkling of gold is also common, produced, no doubt, by gold leaf having been laid on glass, afterwards heated and expanded. Of this kind were the "ii lyttyll ewers of blew glass powdered with golde" which were in the chamber of "domina Mylcentia Fastolf" when the inventory of the goods of Sir John Fastolf was taken in 1459 (printed in the 21st volume of the Archæologia). The glass vessels made at Venice at this period in general bear a resemblance in form to the vessels of silver and other metals made in the west of Europe; they are often of a fine shape but rather massive. The free use of enamel and gilding seems to show that the makers were familiar with the products of the glass-works of Egypt and Damascus; the gilding is much better fixed upon the Venetian than upon the oriental vessels.

In the latter part of this century the influence of the classical revival made itself strongly felt in every department of art, and we find that the workshops of Murano began to produce, instead of covered cups of gothic form, vases and tazzas of classical outlines. The end of the fifteenth and the earlier part of the sixteenth century are the periods to which may be especially ascribed those vases and other vessels whose elegant forms have ever made them the delight of all who have a true feeling for beauty, and which bespeak the artist rather than the artisan.

Much as we now admire these objects, they excited at least as much or even more admiration at the time they were made. Travellers who visited Venice spread abroad the fame of the glass-

EWER.

Venetian, 15th Century. (273-'74.)

houses of Murano, as Bertrandon de la Brocquière in 1432, and Felix Faber of Ulm in 1484: the latter says that such precious and beautiful glass wares were manufactured nowhere else in the world, and tells a story by which it appears that the doge and senate considered a vase of glass a worthy present for the emperor Frederick IV. when he came to Venice. Such, however, was not the opinion of the emperor, who let it fall, and then remarked that glass was in one respect inferior to gold or silver, viz. in being fragile. The doge took the hint and replaced it by a vase of precious metal. Articles of glass for ordinary use were also made at Venice at this time. William Wey, who died in 1474, in the beginning of his itinerary to the holy land advises the pilgrim, when about to take ship from Venice, to provide himself with "dysches, platerrys, sawserrys, other (*i.e.*, or) cuppys of glas." In the first quarter of the sixteenth century the Bolognese monk Leandro Alberti visited Murano, and says that there were then twenty-four glass-houses at work; among the masters he makes special commendation of Francesco Ballerino, and describes, among the remarkable objects made of glass, a galley with all its tackle, a braccio in length, and an organ which produced melodious sounds.

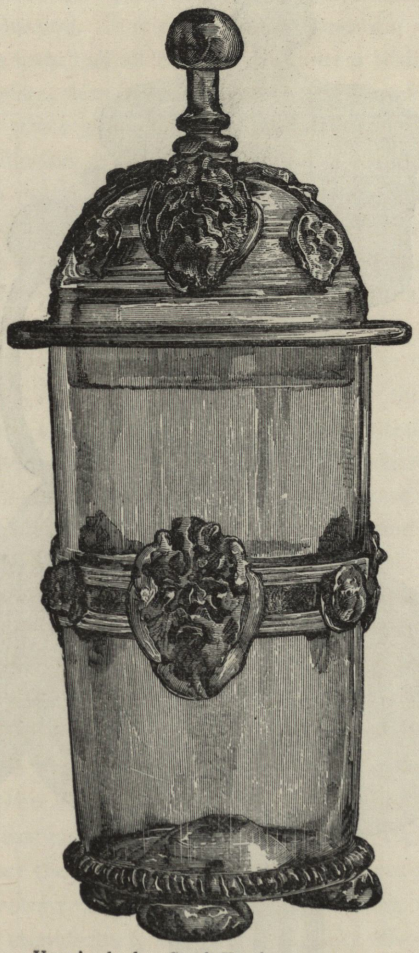
The Venetian republic manifested the high esteem in which it held the art of glass making by the bestowal of peculiar privileges on those who practised it. An enactment of 1490 placed the corporations of glass makers under the immediate jurisdiction of the council of Ten, withdrawing them from that of inferior authorities; and in 1502 the code of law known as the Statuto di Murano, which regulated the administration as well as the civil and criminal justice of the island, was confirmed by the senate. This code remained in force until the fall of the republic. Mention has been already made of the measures adopted in the thirteenth century to prevent the carrying of the art to foreign countries. In 1547, according to Bussolin, the council of Ten adopted further measures of precaution with the same view; the inquisition of State, by the

twenty-sixth article of its statutes of 1454, as given by Daru, had already ordered that if a workman of any kind should transport his craft into a foreign country to the injury of the republic, and refuse to return, an emissary should be commissioned to put him to death. Daru adds, on the authority of a report preserved in the French archives, that this punishment was executed upon two workmen whom the emperor Leopold had induced to enter into his kingdom.

About this period several foreign rulers procured workmen from Murano and endeavoured to introduce the art of glass making into their countries. England, Spain, and Flanders were of the number; in Spain and Flanders some amount of success was obtained, and partly perhaps in consequence we find that on the 7th September 1549 (Cal. state papers, Venetian, No. 574), at a meeting of the glass trade at Murano the artisans complain that they are left out of work two months and a half at a time. At the same time it was agreed that the council of Ten should be petitioned to take measures to prevent the manufacture from being carried out of Murano. Shortly afterwards the council of Ten ordered that masters and artisans in glass who were abroad should return, that recusants or those who might afterwards depart should be fined and sent to the galleys, and that no foreigners should be employed in the glass-houses. Some of the results of this measure will be seen when we come to the history of glass making in England.

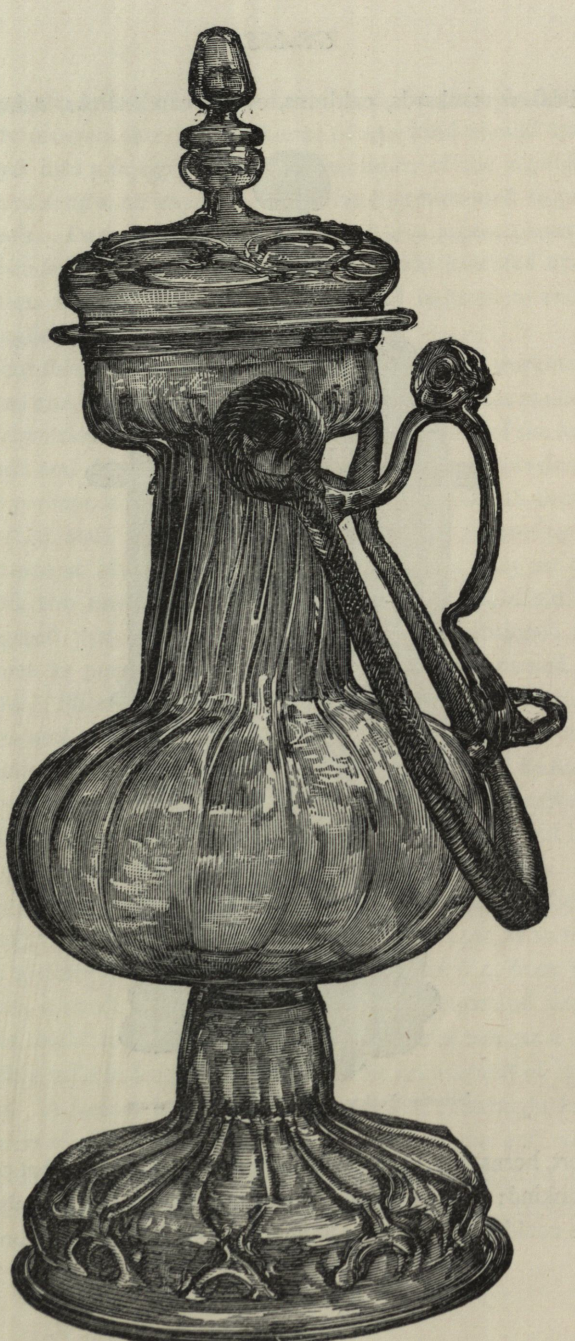
The account of the state of the art given by Coccio Sabellico in his book "De situ Venetæ urbis," written about 1495, is so interesting as to deserve quotation at length. "Thence (*i.e.*, from Venice) Murano, a street, but which from the magnificence and size of its edifices might to those who beheld it from afar appear a city; it extends a mile in length and is illustrious on account of its glass-houses. A famous invention first proved that glass might feign the whiteness of crystal, and as the wits of men are active and not slothful in adding something to inventions they soon began to turn the material into various colours and numberless forms. Hence come

cups, beakers, tankards, caldrons, ewers, candlesticks, animals of



Venetian beaker, South Kensington museum.

every sort, horns, beads (?), necklaces; hence all things that can delight mankind; hence whatever can attract the eyes of mortals; and what we could hardly dare to hope for, there is no kind of precious



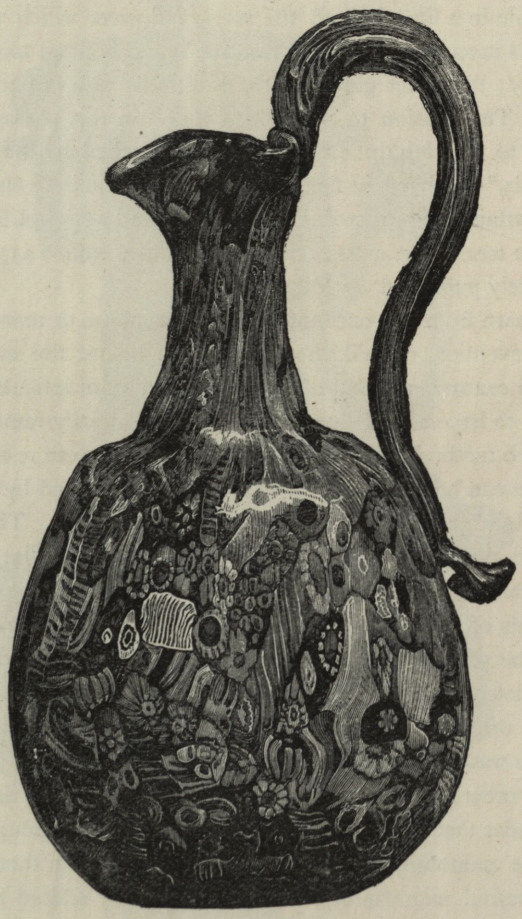
Venetian ewer, late fifteenth century, South Kensington museum.

stone which cannot be imitated by the industry of the glass-workers. Hence come vases the equals of the murrhine, unless cost may be a source of pleasure. But consider to whom did it first occur to include in a little ball all the sorts of flowers which clothe the meadows in spring. Nor has invention been confined to one house or family; the street glows for the most part with furnaces of this kind." The allusion to "murrhina vasa" in this passage has reference to the description of glass usually called by the Germans "schmelz," which was at first made in order to imitate chalcedony; it was certainly known at this time, for we find a receipt for making it in the treatise on glass making which dates from 1443, and has been lately published by Milanese.

We learn from this account that the invention, or more properly the re-invention, of mille fiori was made before the end of the fifteenth century, and that of vitro di trina, lace or reticulated glass, appears to have soon followed. It has been already remarked that these two methods of ornamenting glass vessels were re-inventions, for there can be little doubt that they were suggested by the specimens of antique glass which were occasionally found. These beautiful and diversified productions were highly valued at the time they were made, and were thought worthy to appear at the entertainments of the highest classes of society, where they took very much the place which porcelain now occupies, just as happened at the later Roman period. In the early part of the sixteenth century oriental porcelain was of the greatest rarity in Europe; majolica was then only approaching its highest point of perfection, and the other earthen manufactures were of a very rude description. No wonder that the rich and luxurious of the time sought variety from the monotony of gold and silver by availing themselves of this beautiful manufacture, which almost daily offered new forms and new colours capable of pleasing the most fastidious taste.

The practice of making vessels in the forms of animals, fish, ships, &c., was fully established in the fifteenth century; probably, however, few if any examples of the work of that cen-

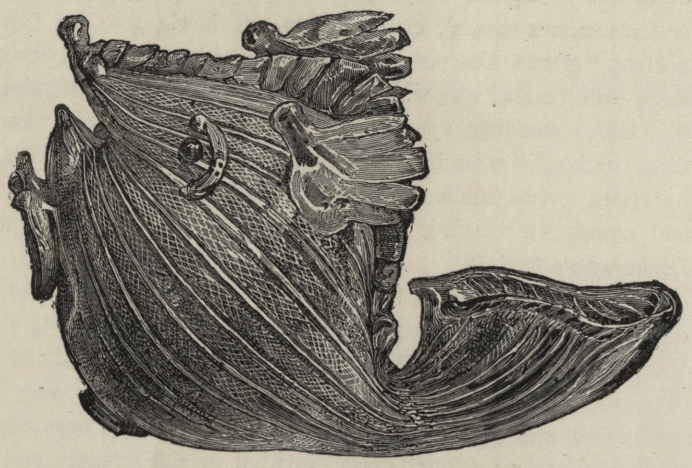
tury, nor many of even the following, are now in existence; and the greater number of those preserved in collections are most



Venetian mille fiore, South Kensington museum

likely the work of the seventeenth century, during at least the earlier part of which such vessels continued to be in vogue. René

François, chaplain to Louis XIII., mentions them in a curious passage in his "Essay des merveilles de la nature et des plus nobles artifices:" "Mourano de Venice a beau temps d'amuser ainsi la soif et remplissant l'Europe de mille et mille galanteries de verre



Grotesque vessel, Venetian, sixteenth century (?) South Kensington museum.

et de chrystal fait boire les gens en depit qu'on en ait; on boit un navire de vin, une gondole; on avale une pyramide d'hypocras, un clocher, un tonneau, un oyseau, une baleine, un lion, toute sorte de bestes potables et non potables. Le vin se sent tout étonné prenant tant de figures, voire tant de couleurs, car dans les verres jaunes le vin clairet s'y fait tout d'or, et le blanc se teint d'écarlate dans un vin rouge. Ne fait-il pas beau voir avaler un grand trait d'écarlate, d'or, de lait, ou d'azur?" From this we see that these strangely shaped vessels were not merely objects of curiosity or parade, but intended for at least exceptional use.

An instructive instance of the variety of articles, and the extent to which they were employed in a royal household, is afforded by the inventory of effects belonging to Henry VIII. in 1542, which were under the custody of Sir Anthony Denny at the palace of

Westminster. As the greater part of the articles of glass were no doubt of Venetian workmanship, it will not be improper to notice them here in connection with the history of the Venetian manufacture. Nearly 450 articles of glass were enumerated, consisting of bottles or flagons, "layers," (vessels for washing, with covers and sometimes spouts), ewers and basons, bowls, standing cups, goblets, "glasses like pottes," sometimes with covers and sometimes with "eares," and with one or more handles, "great glasses like bolles standing upon fete," "cruses," spice plates, "lowe candlestickes," "great bell candlestickes," "aulter candlestickes," trenchers, spoons (the handles only being of glass), "platers, dishes and sawcers," a "casting bottell," a "baskett," and a "hollywater stocke with a bayle."

Many of these were of blue glass, or of blue glass partly gilt: one "leyer" is of "blewe glasse partly gilt, the leyer having the Kinges Armes gilt upon it." One bason and ewer, several bowls, cups, and the "baskett with two eares," are of "diaper work of sundry fashions," probably "vitro di trina." Many of almost every sort are of "jasper colour," doubtless what we call schmelz, and a few are described as "painted white galley fashion," *i.e.*, enamelled white, like majolica. Some spice plates and some cruses are of green glass. Two "litle standing cuppes with covers chalice fashion," and some glasses "like pottes," and a cruse, are of "glasse of many colours," possibly mille fiori. Four standing cuppes were of blewe glasse "paintid and gilt." Four glasses and one little glass are described as having "long smale neckes and great bellies." These last were probably specimens of those strangely shaped glasses which have been supposed to have been intended for alchemical purposes. One article is described as "oone glasse garnisshid in the top with silver like a frame with belles of silver hanging in it;" and again, "oone thike glasse of christall with a cace of lether lyned with crymsen vellat." A "lowe candlesticke," is of jasper colour, and four "lesse bell candlestickes" of glass, partly gilt. The expression "bell candlestick" describes a form

TAZZA BOWL.

Venetian, late 15th Century. (5491–'59.)

well known through Venetian examples of brass, engraved and damascened, which exist in collections; but candlesticks of glass of this period are rare. The casting bottle was, we suppose, of the same fashion as those still used in the east for sprinkling perfumes over guests. The "hollywater stocke" was a small pail for holy water; Mr. Burtt supposes the "bayle" to be a handle, but it is probably a ladle.

Venetian tazza, sixteenth century, South Kensington museum.

A remarkable example may still be seen of a banquetting table set out with its services of glass, which probably remains, for the most part, as when originally arranged about this period. This is to be found in the Sacro Monte at Varallo in Piedmont, where is an assemblage of about fifty oratories, each containing groups of figures of life-size, modelled in clay, with all the accessories required by the subjects, which are nearly all events in the history

of our Saviour. In that of the Last Supper, the table and a side-board are furnished with vessels of Venetian glass, chiefly tazzas and cups, and as the oratory is locked up and glazed in front these things may have remained uninjured from the time at which they were first placed there. The Sacro Monte was begun about 1486, but the greater part of the oratories was constructed during the first seventy years of the sixteenth century.

Venetian wine-glass, sixteenth century, South Kensington museum.

A very curious account of the employment at banquets of these ornamental vessels may be found in the "aggiunta" (dated Venice, 1593) to *Il trinciante* of Vincenzo Cervio, in which is a description of the banquet given at Mantua in May 1581, at the marriage of the prince of Mantua: "There was there, besides most rich side-boards and ordinary glassware, a display of various beakers, de-canters, jars, and other most beautiful vessels of Venetian crystal,

so that I think all the shops of Murano had met there; and of that there was need, for all the signori invited, after they had drunk, broke the beakers, which they held as a sign of great joyfulness."

The usage of breaking the glasses after drinking from them will be familiar to all acquainted with the social customs of this as of other European countries, in the sixteenth and seventeenth centuries. It must have been eminently "good for trade," and contributed to the prosperity of Murano.

Avanturine glass, in which numerous particles of copper (or of silicate of copper) are diffused through a transparent yellowish mass, was, according to the Zanetti, invented about the beginning of the seventeenth century by one of the Miotti. That family preserved the secret, and in 1772 M. de la Lande says it was made in one glass-house only. Even now it is only made in two or three, and sells for from four to eight shillings per pound.

During the seventeenth century the manufacture of glass continued to prosper at Murano, and many of the larger and more striking objects preserved in collections may be attributed to this period. England then imported large quantities of glass for table use from Venice. In the Sloane manuscripts in the British museum are copies of several letters addressed in 1667 by an English glass merchant, John Greene of Holborn, to his correspondent at Venice, specifying the forms and colours of the vessels which were to be sent.

The Comune of Murano had the privilege of causing a certain number of medals or tokens to be annually coined at the Venetian mint; they were made of the same size as the coins known as *oselle*, and bore the arms of the reigning doge, of the comune, the podesta, the chamberlain, and the four deputies of Murano. . These coins were presented to the local magistrates and to some of the higher authorities of the Venetian republic. When it was desired to make a present to some distinguished visitor to the island, one of the coins was enclosed in the substance of the bottom of a cup and thus formed a significant present, and a memorial of the special industry

of the island and of the ample privileges with which the sovereign state had honoured it. The first of these "oselle Muranese" which has been preserved is of the year 1581; there is a gap in the series from thence to 1673, from which it is nearly complete until 1796. A good series is in the British museum, commencing in 1674; and the mode of enclosing the coin is illustrated by a specimen where a *mezzo zecchino* of the doge Francesco Molini, 1646-55, is in the stem of the goblet. A drinking-glass is in the British museum which is said to have come from the palace of Whitehall, having a threepenny-piece of Charles II., dated 1679, enclosed in the stem. The glass seems hardly to be so ancient.

During the eighteenth century the manufactories of England, France, and especially of Bohemia, had begun to compete successfully with those of Murano; the cut glass in particular which they produced had come into fashion, and the demand for the peculiar productions of Venice was correspondingly reduced. One of the manufacturers of Murano, Giuseppe Briati, determined to learn the new processes by which the Bohemian glass makers were enabled to obtain such beautiful results, and accordingly worked for three years in a Bohemian glass-house in the disguise of a porter. Returning to Venice he received, in 1736, a patent for ten years to manufacture glass after the fashion of Bohemia. His neighbours at Murano, however, persecuted him so much through envy that in 1739 he obtained permission to establish a glass-house in Venice itself. Here he worked for many years with very great success, particularly in the manufacture of mirrors with frames of glass, ornamented either in intaglio or with foliage of various colours; and also on the production of chandeliers with flowers, leaves, and bunches of grapes.

Briati was also extremely successful in vases of "vitro di trina," or "siligrana;" these he made with such taste and lightness, and of forms so fully equal to those of the best productions of the cinque-cento period, that they are often supposed (particularly in England) to be of an earlier period. The works of Briati may be

distinguished by the superior purity and brilliancy of the glass; they were so much admired that at the public banquets of the doge they were placed on the sideboards among the gold and silver plate, and the demand for them and the quantity made were proportionately great. M. de la Lande, who visited Venice in 1765-66, mentions Briati as making objects of the greatest delicacy, and particularly lustres, 6 or 7 feet in diameter, which were known as "ciocche." Briati died in 1772. At the time of De la Lande's visit there were fifteen glass-houses working at Murano, but only one, that of "Jean Mota," made mirrors, the largest of which measured 4 feet 9½ inches square. No mirrors, he says, were preferred to those of Venice except the French, which were far more costly.

The fall of the republic was accompanied by the interruption of trade and the decay of manufacture, and the glass makers had to confine themselves to the production of beads and of articles of a common sort for domestic use. In the year 1838 the ancient processes of glass-working were revived by sig. D. Bupolin, and carried on by Pietro Bigaglia, sig. Lorenzo Radi, and others. In our own day Salviati and his English associates have not only imitated with great success the ancient models but have struck out new ideas; and great taste, invention, and good workmanship have been shown in the productions of their furnaces.

The ornamental productions of the glass works of Murano are extremely varied in character, and have been well classed by Mr. Franks in six divisions, viz.—

1st. Vessels of colourless and transparent glass, or glass of single colours, that is, glass coloured with metallic oxides before being worked into vessels. Clear white glass is generally used for drinking-glasses, but they are not unfrequently decorated with coloured glass laid on in threads externally, or forming part of the ornaments attached to the stems; these last are very commonly twisted and made to assume the most fantastic forms. The coloured glasses are usually blue or purple, but green, amber, ruby, and an opal white are met with; the last two appear not to be of early intro-

duction. A few examples occur where two colours are employed, one internally, the other externally.

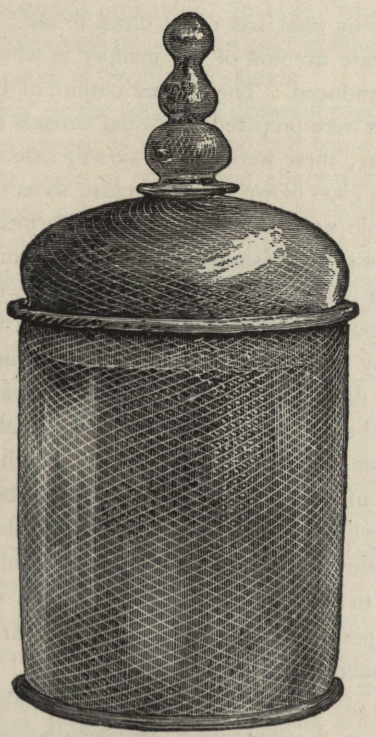
2nd. Gilt and enamelled glass. These methods of decoration were employed on both coloured and colourless glass: some examples of the fifteenth century have been already noticed. The cups and vases of that period are generally rather massive; in the sixteenth century, when extreme lightness and elegance of form were sought after, the drinking-glasses were too thin to bear the heat of the enamelling furnace without losing their shape. The enamelling was therefore in a great measure confined to tazze, bowls, or salt-cellars; the decorations are chiefly coats of arms, the lion of St. Mark, or merely flowers and dots, in place of the portraits, processions, and other elaborate subjects employed in the previous century. In late times dishes and tazze are sometimes found not enamelled but painted on under their surface in oil colour.

3rd. Crackled glass. This, which has a surface rough and divided irregularly by ridges, like ice frozen in the wind, is supposed to have been made by suddenly cooling the vessel when half blown, and then re-heating and expanding it, so as to increase the distance between the sections into which the surface was cracked by the sudden change of temperature; according to M. Peligot it is made in Bohemia by rolling the "paraison" or ball of glass at the end of the tube used by the glass-blower upon fragments of glass which adhere to it, after which the mass is re-heated and worked in the ordinary way. Crackled glass is believed to date from the sixteenth century.

4th. Variegated or marble opaque glass, commonly known by the German word *schmelz*. The most common variety is a mixture of green and purple, which, by transmitted light, appears deep red; sometimes it resembles jasper, sometimes chalcedony; other varieties are imitations of lapis lazuli and tortoiseshell; and an opaque white, speckled with blue and red, is met with. Avanturine may be included in this class, and patches of it are sometimes

found mixed with schmelz These appear to belong in great part to the seventeenth century, but the jasper colour was made in the fifteenth century. Avanturine, as has been stated, was invented in the seventeenth century.

5th. Mille fiori or mosaic glass. This is made from sections of



Venetian vitro di trina: South Kensington museum.

the *canne*, or rods, which exhibit patterns. Such wares are clearly imitations of the ancient Roman process, but are not executed with as much taste and success. The process would appear to have been tried in the fifteenth century, as it is mentioned by Sabellico.

6th. Reticulated, filigree, or lace glass; called by the Italians

"vitro di trina," "di filligrana," "a ritorti," and "a reticelli." These varieties contain fine threads of glass generally coloured, but sometimes wilk-white (*latticinio*), included in their substance, and are certainly among the most beautiful of the products of the skill of Murano. The idea was no doubt borrowed from antique fragments, but the Venetians far surpassed the ancients, if we may judge the latter by what has come down to us. M. Labarte has given an elaborate account of the manner in which many of the patterns were produced. The general outline of the process is as follows:—Canes were prepared enclosing threads of opaque white or coloured glass; these were placed side by side in a mould, and a thin bubble of glass blown into the midst, so as to adhere to the canes; the whole was then re-heated and formed into a hollow cylinder, which was then fashioned in the same manner as any ordinary glass. An infinite variety of patterns may, it is evident, be produced by modifications of this process. A still further intricacy was obtained by using two cases or cylinders, the lines of which ran in contrary directions; when one of these was placed inside the other and the two welded together a reticulated pattern was produced. A small bubble of air was left at each crossing of the canes, as each of them would project a little above the general surface of the cylinder or case of which it formed a part. An extraordinary amount of dexterity and skill in manipulation must have been required to produce works so minute and delicate in their details, and so perfectly exact and regular in their patterns, as are the finest specimens of this kind.

The thinness of Venetian glass made it unsuitable for cutting or engraving; but in the eighteenth century the desire to produce objects in the fashionable style of the time induced the manufacturers, and probably Briati in particular, to make some essays in those modes of ornamentation; one of these in the Correr museum, a decanter, has the arms of Foscari with a cypher of A and F, cut with the wheel; this must have been made for Alvise Foscari, doge of Venice from 1735 to 1741, and we think by Briati. A few

examples are engraved with ornaments of flowers and foliage with a diamond point.

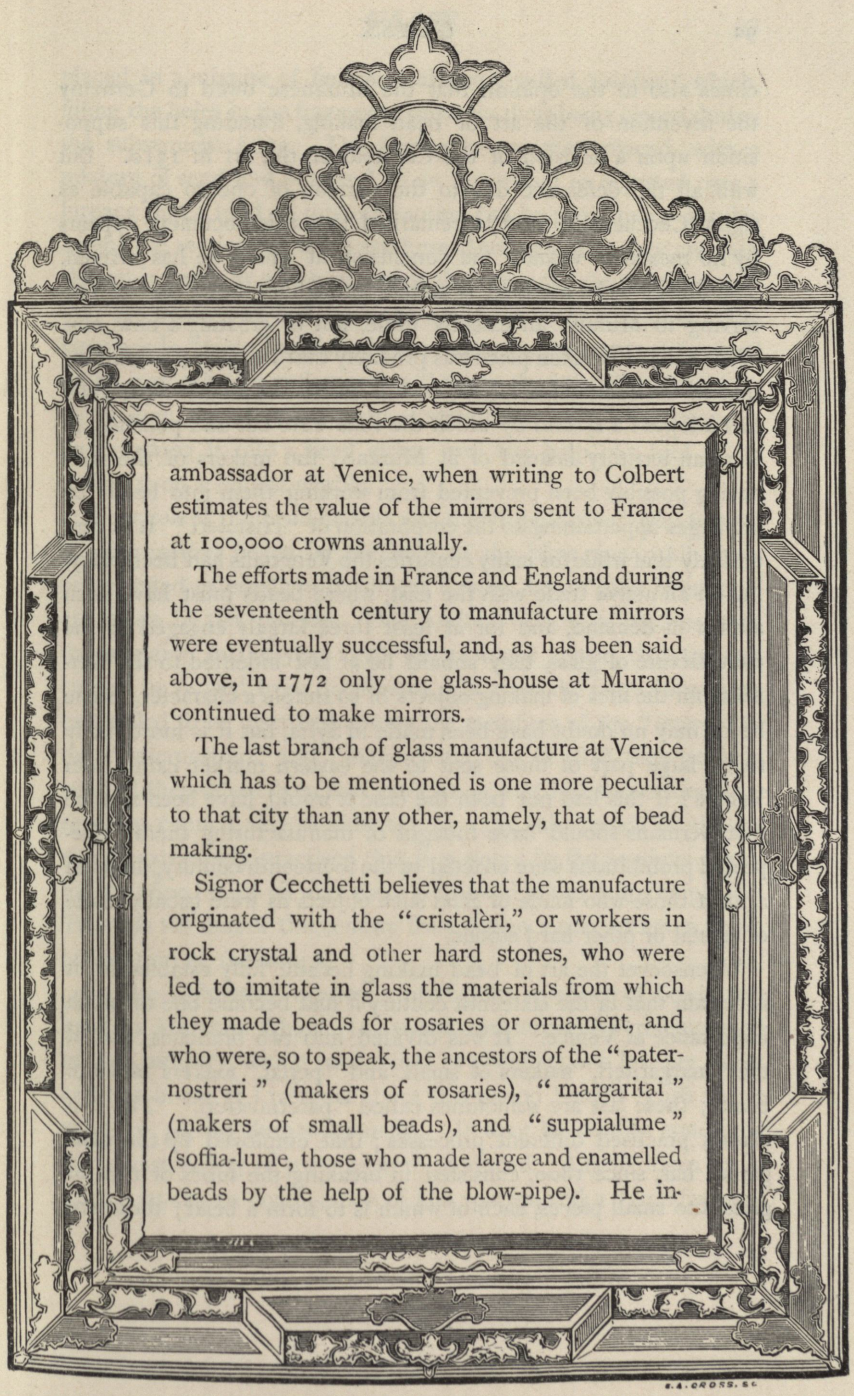
Very few notices of the making of glass for mosaic are found either in the Mariegole or other documents. In 1317 a decree of the great council granted to Giovanni di Murano "fiolajo" permission to work in making "smalti" even during the months when the making of glass was prohibited. In 1589 Pietro Ballarin made "smalti" of various colours and with gold ground, and furnished these for the mosaics of St. Mark's church.

The "cristallai," as the makers of glasses for spectacles came to be called, would appear to have owed the name to the fact that lenses were first made of crystal and afterwards of glass. Eye-glasses are believed to have been invented by Salvino Armato degli Armati, a Florentine, about the year 1286. Alessandro Spina is sometimes credited with the invention. Signor Cecchetti has found in a "capitolare" of the workers in crystal, under date of the 2nd April 1300, a prohibition to buy or sell several classes of objects of white glass counterfeiting crystal: among these are "roidi da ogli" and "lapides ad legendum," obviously lenses. In a very short time the prohibition was withdrawn, and in 1301 permission was given to make "vitreos ab oculis ad legendum." This branch of glass making continued for a long time to flourish at Venice, and Garzoni (circa 1580) names two spectacle makers at Venice as being in the greatest repute, among the many who practised the art.

The method of forming a mirror by backing glass with metal was, if not known to the Romans of the imperial period, well known in the middle ages. John Pecham (circa 1279), in his treatise on optics, says that mirrors of glass are lined with lead. Roger Bacon, Vincent of Beauvais, and Raymond Lully, all state the same thing. Beckman (hist. of inventions,) says that before the year 1500 mirrors were made in Nuremburg by blowing into the glass bubble, still hot, a metallic mixture with a little resin or salt of tartar. The bubble was then cut into small round mirrors. The first mention of the making of glass mirrors at Venice would

appear to be a petition from Nicolo Cocco and two others, in 1317, stating that they had made an agreement with a "magister de Alemania" who knew how to work glass for mirrors; that he had broken his agreement and departed, leaving on their hands a great quantity of alum mixed with soot; and they asked permission to sell the alum in question, the exportation of which from Venice was prohibited. There is some evidence that in 1498 an attempt had been made to introduce the manufacture of glass mirrors. Soon afterwards, viz. in 1507, we find that two men of Murano, Andrea and Domenico dal Gallo, addressed to the council of Ten a petition stating that they possessed the secret of making good and perfect mirrors, a secret which had hitherto been in the possession of only one German glass-house, and asking for an exclusive privilege for twenty-five years. One for twenty was accordingly granted. Such, probably, were the mirrors which Pigafetta who accompanied Magellan in his voyage round the world between 1519 and 1522 says were taken with them; that they were of glass is proved by his statement that many were cracked. The glass mirrors made even in the sixteenth century were not always perfect, for metal plates continued to be used, as may be seen in the magnificent mirror-case of steel damascened with gold in the South Kensington museum, which was made in 1550. The plate of the mirror in the Louvre, presented to Marie de Medicis by the republic of Venice in 1600, is said to be of rock crystal.

The "specchiai" or mirror makers formed themselves into a "scuola" or corporation, according to Cecchetti, in 1569-1570. By one of the regulations every one claiming to be admitted as a "capo maestro" had to prove his ability to flatten and polish a piece of glass of 17 (inches?), and to apply the "foglia" or leaf of metal. The Venetian mirrors were formed by blowing glass into cylinders, which were then slit, flattened out on a stone, and polished on a table. During the next two centuries mirrors were made in very large quantities at Murano and exported to almost all countries both east and west. In 1664 the bishop of Beziers, then French



ambassador at Venice, when writing to Colbert estimates the value of the mirrors sent to France at 100,000 crowns annually.

The efforts made in France and England during the seventeenth century to manufacture mirrors were eventually successful, and, as has been said above, in 1772 only one glass-house at Murano continued to make mirrors.

The last branch of glass manufacture at Venice which has to be mentioned is one more peculiar to that city than any other, namely, that of bead making.

Signor Cecchetti believes that the manufacture originated with the "cristalèri," or workers in rock crystal and other hard stones, who were led to imitate in glass the materials from which they made beads for rosaries or ornament, and who were, so to speak, the ancestors of the "paternostreri" (makers of rosaries), "margaritai" (makers of small beads), and "suppialume" (soffia-lume, those who made large and enamelled beads by the help of the blow-pipe). He in-

Venetian mirror frame: South Kensington museum.

clines also to the opinion that the Muranese owed to Germany the invention of the art of bead making, founding this supposition upon a decision of the Capitolo of the art in 1510. But with all the deference due to the opinion of one so capable as signor Cecchetti, it must be remarked that this document appears by no means to warrant the conclusion at which he has arrived. The object to be attained is stated throughout to be that of preserving to Murano an existing trade, not of creating a new one. What had really taken place was probably that the Germans, finding that in the mountains labour was to be had at a very cheap rate, had adopted a system by which the rods were cut and polished in German territory instead of at Murano; the makers of the rods having possibly been prevented from working them into beads by privileges appertaining to the corporation of "cristaleri" It is very unlikely that while for many centuries the Venetians had been carrying on an active trade with the east, where beads must have been always in demand, and for at least three largely engaged in the manufacture of glass, they should be at last indebted to the Germans for the idea of making objects of so simple a character. Some beads may no doubt have been made in Syria, but it is more likely that a large part of those sent to the eastern market came from Venice; if this had not been the case it would have been strange that Germans should have thought of manufacturing them. Repeated prohibitions were enacted in the fourteenth century, directed against those who made of glass such objects as were usually made of crystal or other hard stones.

Whensoever the art of bead making became fully established, it is certain that in the sixteenth century it had become one of much importance at Venice. It was divided into two branches, that of the "margariteri," makers of small, and "perlai," makers of large beads; these last are sometimes called "paternostreri." The two classes practised different processes; that employed by the margaritai has, since 1800, consisted in breaking the tubes or rods of glass into small pieces, each of which is to form a bead; these are

placed in a mixture of lime and charcoal called "siribiti" which, filling the holes in the fragments, prevents their being closed during the subsequent firing. The fragments are then placed, with a mixture of sand and charcoal, in an iron vessel so adjusted over a furnace that a kind of rotatory motion can be given to it. By this means the sections of tubes are formed into globes; they are then shaken in bags, by which operation the stoppings are removed, and they are finally polished by being shaken in sacks with bran. The large beads, "perle," were made by placing the fragments of "canne" on an iron cylinder and exposing them to the heat of a furnace, or by twisting the glass in a state of semi-fusion round the cylinder, and working it into a bead either with the help of a tool or by rolling it on a slab of marble.

A section of the bead-makers was the "fuppialume," who formed or ornamented beads by the help of the blow-pipe. All those ornamented externally with foliage, flowers, &c., of glass or enamel, are made by this process. One Andrea Vidaore is credited with its invention in the year 1528, but it would appear that the fact cannot be proved from documents. In 1629 the fuppialume were compelled to be inscribed among the members of the "scuola" of the "paternostreri" and "margariteri," but in 1648 they partially severed themselves from that association, and had thenceforward a separate council and president. In 1731 this branch of the art was so extensively practised that it is stated by the brothers Bertolini that 800 lbs. of oil were daily consumed in the lamps employed. Towards the end of the century from 600 to 1,000 workmen found occupation at the lamps.

In the eighteenth century a prodigious quantity of beads was made at Murano. About 1764 twenty-two furnaces were employed in that industry, with a production of about 44,000 lbs. per week, and one house at Liverpool about this period bought beads to the value of 30,000 ducats annually. It may be readily conceived that a vast variety of patterns were produced. A tariff drawn up in 1800 contains an enumeration of 562 species, and a "grandissimo"

number of sub-species of beads. The manufacture continues to be one of great importance, the annual export amounting in value to nearly 200,000*l.* per annum.

A few words may be said, in conclusion, upon the composition of Venetian glass. The lightness and strength are, it is well known, due to its not containing lead like our modern flint glass; and this lightness enabled the makers to produce those marvels of delicacy and slightness which we admire so much. As has been seen, earnest endeavours were made to keep the processes of manufacture secret, and these have so far succeeded that few particulars of the manner in which the manufacture was conducted have been made public. The manuscript of 1443 referred to above contains many recipes for making various kinds of glass, but they are difficult to understand, the words used being unfamiliar and their meaning obscure. One recipe directs 200 lbs. of the rough soda, 40 lbs. of tartar (gromma) deposited from wine, 150 lbs. of pebbles from the Ticino, and 7 oz. of manganese, to be used to make "cristallino." Alum was used as early as the fourteenth century as a material supplying alkali, but it produced bad glass, and its use was therefore prohibited by decrees of the great council in 1306 and 1330. Biringuccio tells us that the materials for glass were alkali, obtained either from the ashes of a "herba calida" brought from Syria or from the neighbourhood of Maguelonne near Montpelier, or from those of fern or of "uznea" (moss, or lichen, or seaweed?) and pebbles of white quartz, or if these were not to be had, white, sharp sand. Two parts of the sand, or pebbles, and one of the alkali were to be well mixed with a certain quantity of manganese, and the whole melted in a reverberatory furnace. The mass thus obtained when broken up, he says, was called "fritta," and he then proceeds to give directions respecting the form and dimensions of the furnaces and pots in which the glass was to be melted for working.

Garzoni, who wrote about 1580, gives a very similar account, but says that the glass made with the alkali obtained from fern ashes

was yellow and weak, and calls the plant named "uznea" by Biringuccio "ugnea." The ashes brought from the east or from Syria, according to him, were the best, but they were also brought from France. It seems not unlikely that the *cenere* obtained from ugnea, or uznea, was kelp. Iron calcined, he states, gave a red colour, tin a white, copper a green, and lead an emerald hue. Much information will be found in a work lately published ("Le verre," by M. Peligot) on the chemistry of glass, and the means by which various colours are produced. This however describes modern rather than ancient practice.

The productions of Murano so entirely eclipsed those of other Italian cities that it is difficult to find any mention of their efforts in glass making. Much painted glass was, however, produced in Italy throughout the middle ages, and all would not have been made at Murano. We have already spoken of a petition presented to the grand council in 1295, asserting that glass furnaces existed in seven of the most important cities of northern Italy, and it appears from an "acte testimonial" published by M. Filon that in the city of Faltare (Falletto?), in the marquisate of Montserrat, there were consuls of the art of glass making in 1495. About 1623 Sir R. Mansel procured a "whole company of glass makers from Mantua," and in the same year Anthoine Miotti addressed a petition to Philip IV. of Spain, in which he asserts that Rome had two establishments for glass making, Florence one, and that Milan and Verona had tried to set others on foot. Probably some of the vessels which we suppose to be Venetian are the produce of these glass houses. It seems strange to find that notwithstanding so much glass making glass was but little used for windows; and Sir R. Worsley (manuscript journal of travels, at Brocklesby park, Lincolnshire) thus wrote in 1688: "A pretty big town called Murano where they make ye fine Venice glass; in all the great towns of Italy except Genoa and this city they have paper in their sashes instead of glass."

CHAPTER VI.

Glass in France and Spain.

Pliny tells us that glass was made in Gaul, and there is good ground for thinking that glass making was carried on there on a considerable scale and in many places. In the musée lapidaire at Lyons is preserved an inscription, No. 171, to the memory of Julius Alexander, a citizen of Carthage and worker in glass. Much antique glass has been found in Normandy and in Poitou. In the former country many vessels of a somewhat peculiar form, simulating small barrels, have been found in tombs, probably of the second or third century; they bear the makers' marks—Fro, Front, Frontiniana. The name Amaranus appears on a fragment of glass found at Brotonne (Cochet), and Galgacus on a vessel in Poitou.

It seems probable that glass making went on in several parts of France under the Merovingian dynasty. Vessels of glass are frequently found in sepulchres of the sixth century. Ruricius, bishop of Limoges circa A.D. 506, writes of a "vitrarius;" and Fortunatus, bishop of Poitiers (ob. 609), in describing a grand banquet says that birds were served in dishes of glass. About A.D. 675 Benedict Biscop procured from France workmen to make glass for the church of the monastery at Wearmouth. In 677, according to Filiasi, many Greek workmen went to France to work in glass. M. Fillon quotes a diploma of Louis le debonnaire (A.D. 825) in which "portus vitreariæ" is named as a bound-mark in the "pays d'herbauges," and finds the name of a Robertus Vitrearius in a charter of 1088. The same writer mentions many other glass makers of

the thirteenth, fourteenth, and fifteenth centuries, who worked in Poitou. In 1466 twelve dozen glasses and one dozen ewers were rendered from the glass-works of La Ferrière to the abbess of Ste. Croix at Poitiers, for liberty to collect fern on her land.

Scarcely any examples of artistic efforts which may be supposed to have come from these mediæval glass houses can now be extant; but we would mention two, which possibly may be of the thirteenth century. The tube in which the thorn given by St. Louis king of France, as one of those of the crown of thorns, is preserved in the treasury of the abbey of St. Maurice in the Valais, and the pieces of glass which encloses it. In the treasury of St. Mark at Venice is a similar reliquary containing another of the thorns, also the gift of St. Louis, and probably in this case also the thorn is enclosed in glass. M. Fillon has engraved a drageoir with the arms of Charles VIII. of France (1470—1498) and foliage in gold of a mediæval character, which may very possibly have come from thence. Engraved glasses of very good style exist which date from the latter half of the sixteenth century.

In 1572 one Fabriano Salviati, "gentilhomme de Murane pais de Venise," came into Poitou to practise his art; and about 1588 certain glass makers named Sarode established works at Fosse de Nantes and at Vendrennes. In the seventeenth and eighteenth centuries the industry declined, partly in consequence of the competition of the works established at La Rochelle and Nantes.

Some, at any rate, of the glass makers of Poitou appear from an early date to have produced utensils of glass; and the settlement of Venetians and others skilled in the art no doubt stimulated this branch of industry, for considerable efforts were made at various times to produce fine and ornamental wares. Several examples of enamelled glasses have been engraved by M. Fillon. On one of these are the arms of a family of Poitou. On a very pretty drinking glass are the words, "A bon vin ne fault point anseigne," *i.e.* "Good wine needs no bush." He also states that many vases, cups, bottles, &c., are still found entire or in fragments, both of white and coloured

glass. Of the latter he mentions some as opalescent, others as marbled, or spotted with a fine rose-red, blue, and sometimes green. Of the former he mentions, as a remarkable example, a *sceau* or pail, about 14½ inches high by 14 inches in diameter, with lions' heads as handles. This is said to have been made in the neighbourhood of Parthenay.

We have records as to some of the French districts. There were glass houses in Provence as early as the thirteenth century, and these in the sixteenth appear to have attained considerable skill. The curious drinking glass No. 824 of the catalogue of the Slade collection in the British museum may with much probability be attributed to some Provençal manufacturer, as the inscriptions show that it was made for one Jehan Boucau, and a family of the name of Boucault existed in Provence. This is of yellowish glass, and enamelled in colours; the costumes of the figures on it indicate the earlier part of the sixteenth century. In 1338 Humbert, dauphin of Viennois, granted to a glass maker named Guionet a portion of the forest of Chamborant to establish glass-works there, on condition that he should furnish the dauphin annually a considerable quantity of glass wares amounting in all to no less than 3,151 pieces.

A very large quantity of glass was made in Normandy, and full details upon the subject will be found in the work of M. le Vaillant de la Fieffe. M. Milet has written the history of a glass-furnace which was at Bezu le Foret, department de l'Eure, at a spot in the forest known as the Fontaine du Houx. A fragment of a roll of accounts in the bibliothèque nationale shows that in 1302 it was worked for account of the king, and that the expense for half a year was 90 livres 16 sols 8 deniers. The alkali was obtained from fern, and the charge for collection and carriage forms part of the account. The glass made was window glass, and called "grossum vitrum." This furnace and others in the neighbourhood, in 1416, were worked by Robin and Lehan Guichard, "voirryers yssus de lignée voirryers de toute ancienneté," and passed from them to the

le Vaillants. Pierre le Vaillant in 1490 had from Charles VIII. letters patent as "ecuier voirrier," confirming his "privileges de verrerie," which included certain rights as regards cutting wood in the royal forests. From that time down to the present century these furnaces, and one at Haye de Neufmarché, were worked by members of the le Vaillant family or their relations. All the workers are styled "gentilshommes," and, as was the case in the other "familles verrières" in the same country, all the proprietors —members of the firm, as we should say—learnt the art, if they did not actually do ordinary work at the furnace themselves.

At what time the practice of considering the making of glass as an art which not only did not detract from nobility of birth but perhaps even conferred it originated in France does not appear; but the above shows that as early as 1490 individual glass makers obtained privileges of "noblesse." M. Sauzay quotes Palissy to this effect: "L'art de la verrerie est noble et ceux qui y besongnent sont nobles." The real state of the case is clearly expressed by the arret of the Cour des aides, at Paris, in 1597: "Sans qu'à l'occasion de l'exercise et du trafic de la verrerie les verriers puissent prétendre avoir acquis le degré de noblesse ou droit d'exemption comme ainsi que les habitants des lieux puissent prétendre que les verriers fassent acte dérogeant à noblesse." In later times the glass-works were on this account the refuge of many of the impoverished Huguenot gentlemen; and M. Coquerel tells us that in 1746 more than forty "gentilshommes verriers" of Conserans, in Gascony, were sent to the galleys for the crime of professing the reformed religion.

The Norman glass works do not seem to have produced anything but window glass and common wares, such as bottles and other domestic utensils.

In the sixteenth century Henri II. brought into France an Italian named Theseo Mutio, and established him at St. Germain-en-Laye. In 1598 Henri IV. permitted Vincent Basson and Thomas Bartholus "gentilshommes verriers," natives of Mantua, to establish

themselves at Rouen, in order to make there "verres de cristal, verres dorés emaulx, et autres ouvrages qui se font à Venise." In 1603 he established manufactories at Paris and Nevers, and it is to them that M. Labarte ascribes an ewer and basin of opal glass formerly in the d'Huyvetter collection at Ghent, with the inscription VIVE LA BELLE AVE MON COEVR AISME, 1625. The ewer is now in the British museum. Such examples are, however, of very great rarity; but it is possible that some of the glasses supposed to be Venetian are really of French origin.

Glass was also made in Lorraine before the sixteenth century.

In 1664 Colbert wrote to the French ambassador at Venice requesting him to procure workmen for a glass-house, but according to M. Sauzay the ambassador replied that if he did so he ran the risk of being thrown into the sea. In 1665 eighteen Venetian glass makers were actually obtained, and a company was formed for the making of mirrors which was established at Paris. Another mirror factory existed at Tour-la-ville near Cherbourg, the property of Richard Lucas sieur de Nehou, the art, according to a tradition mentioned by M. Sauzay, having been brought there by certain young men of Strasburg, who had contrived to obtain surreptitiously a knowledge of the manner in which it was carried on at Venice. Colbert arranged the union of the two factories, and the manufacture flourished and produced great quantities of large plates. The nephew of Richard Lucas, Louis Lucas, is said by M. Sauzay to have invented in 1688 (? 1691) the process of casting glass, which made it possible to produce plates of very great size. Many writers, however, attribute the invention to Abraham Thévart, who made plates 84 inches by 50 inches. In 1693 the factory was transferred to St. Gobain, where the manufacture of glass is still carried on upon a very large scale.

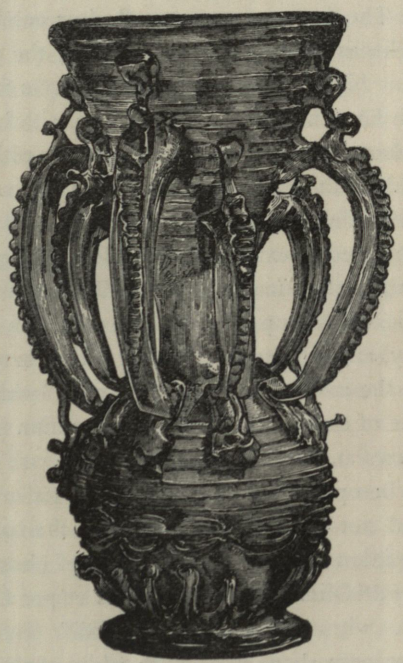
As in the case of France, we have it on the authority of Pliny that glass was made in Spain in his time; and this statement is confirmed by numerous remains of glass furnaces which have been

met with in various parts of that country. Señor y Sinobas says that in the Ibero-Roman period glass was made chiefly in the valleys which run from the Pyrenees to the coast of Catalonia, near the mouth of the Ebro not far from Tortosa, also in Valencia, and Murcia, in the valleys of Olleria, Salinas, Busot, and Rio Almanzora; some centuries later (he thinks) in Cuenca, Toledo, Avila, and Segovia. The furnaces were small, four cubits in diameter and six in height, as appears from their ruins; the pots, truncated cones, one cubit high. Thence came the objects found in tombs in Spain, which he enumerates as small jars with handles; cups; vials without a foot, but with a wide neck; pateras with gold; dishes, thick and moulded salt-cellars, small amphoras, lacrimatories; rings, red, yellow, and gilded; counters and bracelets. The manufacture he believes continued to exist under the Gothic kings, and he goes on to quote a translation made in the twelfth century of the Lapidario of Abolais, who is supposed to have written in Hebrew in the seventh century, and who says of it that it is of several colours—white, which is the noblest; red, green, "xade," which he explains as the dark hue of obsidian, and purple; mention is made also of its use in windows and as a burning lens.

To this may be opposed the opinion of M. Labarte, who thinks that the art did not survive the invasion of the barbarians. He grounds this opinion on the mention made of glass by Isidore of Seville, who says "Olim fiebat et in Italia et per Gallias et Hispaniam . . . vitrum purum et candidum." In strictness, this passage at most only shows that pure white glass was not then made, not that no glass at all was made.

Señor Juan F. Riano, in the introduction to the catalogue of art objects of Spanish production in the South Kensington museum, has supplied much information with regard to the later history of Spanish glass making. He commences the modern history of the art in Spain by stating that an Arab author of the thirteenth century says that Mercia was renowned for the fabrication of glass and pottery, of both which materials large vases of the most ex-

quisite and elegant shapes were made by the Moors; and that "Almeria was also famous for the fabrication of all sorts of vases and utensils, whether of iron, copper, or glass." The making of glass at Barcelona was probably of equal if not greater antiquity. "In a municipal edict of 1324 is a prohibition that the glass ovens



Spanish, sixteenth century, South Kensington museum.

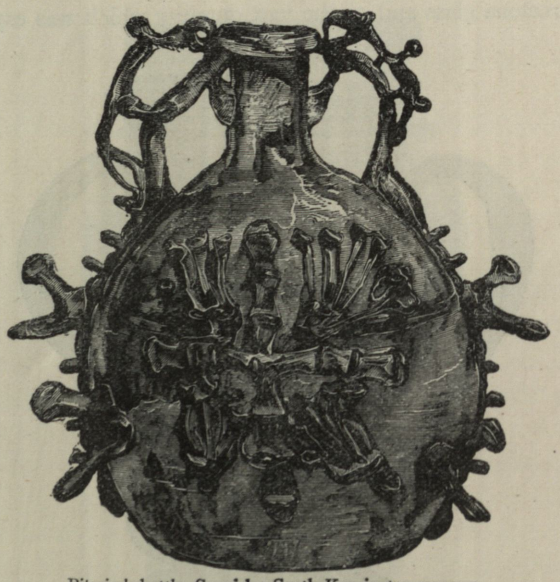
should be inside the city." "In 1455 permission was granted to the 'vidrieros' to form a corporation under the patronage of St. Bernardino, and from this period some of the members figure as holding municipal charges." "Jeronimo Paulo, who wrote in 1491 a description in Latin of the most remarkable things at Barcelona, says they also send to Rome and other places many glass vessels of different sorts and kinds, which may well compete with those

of Venice. Marineus Siculus, who writes at the beginning of the sixteenth century, says that the best glass made in Spain is that of Barcelona; and Gaspar Baneiros in his chronographia, published at Coimbra in 1562, mentions that excellent glass was made at Barcelona, almost equal to the Venetian. From the beginning of the seventeenth century there are frequent allusions to the merit of the Barcelona glass and to the vast quantity which was exported."

Spanish, South Kensington museum.

Glass was also made at Cadalso in the province of Toledo as early as the beginning of the sixteenth century. Other works were at Torre de Esteban, Hambroz, in 1680, which gave the most brilliant results; and at Recuenco in the province of Cuenca in the beginning of the sixteenth century, and in 1722; also in the seventeenth century at Valdemaquada in the province of Avilo. In a royal schedule dated 1680, stating the prices at which things

were to be sold in Madrid, glass made at Barcelona, Valdemaquada, and Villafranca, in imitation of the Venetian, is mentioned; and the glass of Valdemaquada was sold for a higher price than that made at the other places. There was also an important manufactory at La Granja, famous for fine chandeliers, mirrors, and engraved glass.



Pilgrim's bottle, Spanish: South Kensington museum.

What we have of the products of these factories scarcely seems to support the assertion that the glass rivalled Venetian, though several pieces in the collection formed by señor Riano closely resemble the products of Murano. One reason of the success of so many factories making glass of the same character as Venetian, and of the failures of England (as will be seen hereafter), was no doubt that the Spanish, in the interior of a country ill provided with means for the transport of such an article as glass, had not to sustain so severe a competition as the English factories.

Spain is not a country very productive of fuel, and doubtless

when the glass-houses had burnt up the wood in their neighbourhood the manufacture ceased to be profitable. It would seem that, except near the coast, the glass must have been made with potash, obtained from the lees of wine or from burnt wood. The transport of soda, either from Egypt or from the coast on which it could be produced from seaweed, would have been extremely costly. At

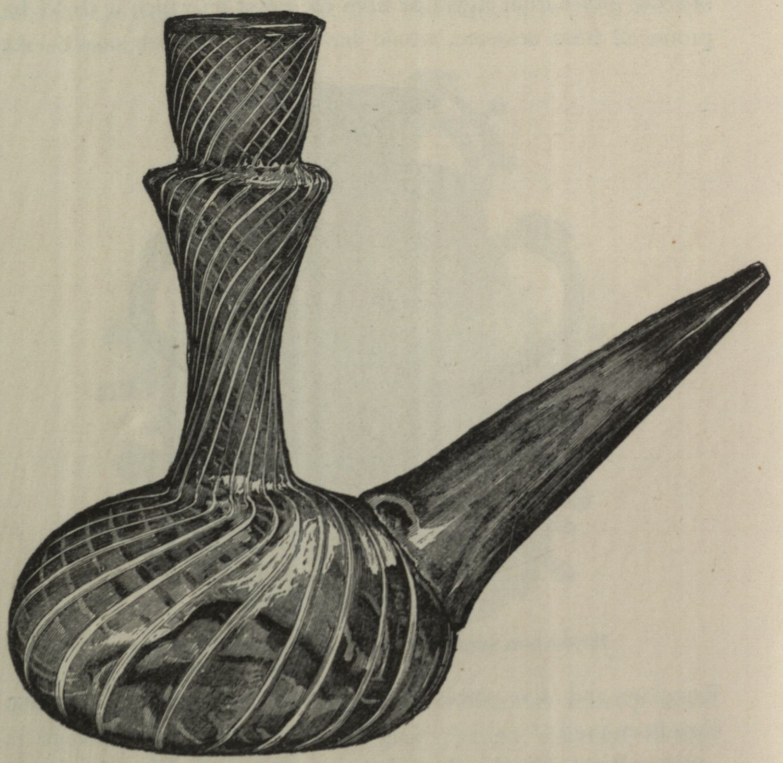
Spanish vase, seventeenth century, South Kensington museum.

Barcelona and other places on or near the coast soda may of course have been used.

Señor Rico y Sinobas has given a very extensive list of painters on glass in Spain, the names of great numbers of whom have been preserved in the archives of the cathedrals. He states that glass for these purposes was, if not made, certainly painted in the immediate neighbourhood, in the closes in fact of the great churches, recording particularly Toledo.

The collection of Spanish glass in the South Kensington museum of an earlier date than the nineteenth century has been entirely

formed by señor Riano, and the attributions of dates and places of manufacture are altogether due to him ; the articles of quite recent make prove that in some factories the old forms and the old system of ornamentation are still in use. The collection is interesting as



Bottle, modern Spanish, South Kensington museum.

preserving a great number of examples of the rude and strange vessels in common use. Spain is an unchanging country, and many of these may be copies of those in use at a very remote period. The singular drinking-vessels, such as Nos. 179—'73, 152.—'73, and others, recall the cup of the cobbler of Beneventum with its four lips which Juvenal mentions in his fifth satire.

Elegance of form is not often to be found; those attributed to Cadalso, which are sometimes thin and well made and simply ornamented with bands and lines of white enamel, perhaps exhibit more of that quality than any others. Of this the jar or ewer 1004—'73 is a good specimen. Some of the examples, as No. 135—73, resemble objects of Venetian make so closely that doubts have been entertained as to their real origin; others again, like those attributed to San Ildefonso in the eighteenth century, bear very close resemblance to the bottles met with in old liqueur-cases, which are believed to be of Dutch origin.

CHAPTER VII.

Glass in the Low Countries and Germany.

Little would seem to have been as yet discovered as regards the early history of glass making in the low countries: perhaps the earliest mention which we have is that in an inventory of Charles V. of France, in 1379: "ung gobelet et une aiguière de voirre blant de Flandre garni d'argent;" but, as M. Laborde has pointed out, "de Flandre" may merely mean glass brought from Venice to the Flemish ports; for Philip duke of Burgundy orders in 1394 a payment of four francs, "pour seize voirres et une escuelle de voirre des voirres que les galéres de Venice ont avant apportez en nostre pays de Flandres." M. Houdoy has, however, brought forward undeniable proof of the existence of the art at Lille: from the accounts of Philip the good, duke of Burgundy in 1453-1454, payments were made to Gossuin de Vieuglise, maître voirrier of Lille, for a fountain of glass and for four plateaux.

In the possession of the writer are a cup and cover of glass of a very fine green, bought at Amsterdam, which is of thoroughly fifteenth century character and may very possibly have been made somewhere in the low countries. It is thicker than Venetian glasses of even the earliest period usually are, and not quite like any that are really known to be of Venetian origin.

In 1509 "ung hault vere de crystal d'Anvers" is mentioned in an inventory; and in 1523 we find in the inventory of Margaret of Austria "ung grant voire vert donné par M.S. (monseigneur, *i.e.* the bishop) de Liège le couvercle et le pied d'argent doré." In

1563 Guicciardini, in his description of the Netherlands, mentions glass as among the chief articles of export from Antwerp to England. In 1599 Philippe de Gridolphi had from the archduchess of Austria a continuation of the privilege granted to Ambrozio de Mongarda to make "voirres de crystal à la faschon de Venice;" but an exemption was made in favour of the comte de Lallaing so far as the making "plats voirres à faire miroirs." M. Houdoy suggests that this was the establishment referred to in 1507 by the two Muranese as possessing the secret of making mirrors. The secret, probably, was the use of amalgam in the place of the imperfect system of attaching a leaf of lead, which was in use in Italy (see p. 89) in the middle of the fifteenth century. In 1600 Gridolphi procured an extension of his patent, and the importation of voirres contrefaits à la façon de Venise was prohibited; but "voirres simples et ordinaires de Bôheme, Allemagne, France, et Lorraine" were admitted.

In 1623 Anthony Miotti (the name is noticeable as that of a well-known family of Muranese glass makers) addressed a petition to Philip IV. of Spain, setting forth that the low countries paid 80,000 florins annually for glass from Venice; that almost all the capitals of Europe were "decorées" with such manufactories; that Venice had four (?), Rome two, Florence one; and that Milan, Verona, and London had tried to establish them. He proposed to make glasses, vases, and cups of various forms, of fine crystal of all colours as well as at Venice, of the same materials, and to sell his wares at one-third less than the Venetian glasses. The privilege was granted, and one Van Lemens joined him in the undertaking. The crystal glasses were not to exceed 25 florins per 100 in price, the "cristallin" 15 florins. In 1642 John Savonetti, "gentilhomme de Murano," obtained a patent for glass making at Brussels with absolute prohibition of all import of glass. He states in his memorial that he had been banished and his goods confiscated for having brought glass making to the low countries.

From some of the glass-houses established in the end of the

sixteenth or beginning of the seventeenth century came the glasses, often of very elegant form, which are to be seen in the paintings of Jan Steen, Mieris, Terburg, and other artists of the time. M. Houdoy notices a few remarkable existing specimens which he thinks may be safely ascribed to the glass-houses of Flanders or Brabant; one of these in the museum at Audenarde bears the date of 1602. On the one side a stalk of lily of the valley is enamelled, on the other a young gentleman in a rich pourpoint, with a lady on his lap. Another, in the musée de la porte de Hal, is of Venetian form, but with the arms of the city of Antwerp upon it. He also mentions an example of the "verres au moulin," long glasses, the lower end of which is fixed in a mounting of silver, on which is a windmill of silver which the drinker is bound to set in motion by his breath after he has tossed off the contents of the glass. The example he specially mentions is engraved near its upper end, and below this is encircled by a thread of blue glass between two of white; from this triple ring blue and white threads descend to the lower extremity.

Glass in Germany.

The quantity, variety, and peculiarity of the glass vessels which have been found in the neighbourhood of Cologne, of Treves, and other places in Germany not very distant from the Rhine, have led to the supposition that glass making flourished in those provinces during the Roman occupation. Whether it was continued after that time does not seem to be clear. Many drinking-vessels of glass, very similar to those found in the graves of the Saxons in England and in France, have been found in graves in Germany; but whether they were made in all three countries by kindred tribes or were the produce of one, and if so of which country, are questions yet unsolved.

Some examples of German drinking-cups of this date are engraved in Wright's "The Celt, the Roman, and the Saxon," pp. 425, 426. The practice of using drinking-cups of glass would seem to

WIEDERKOM.

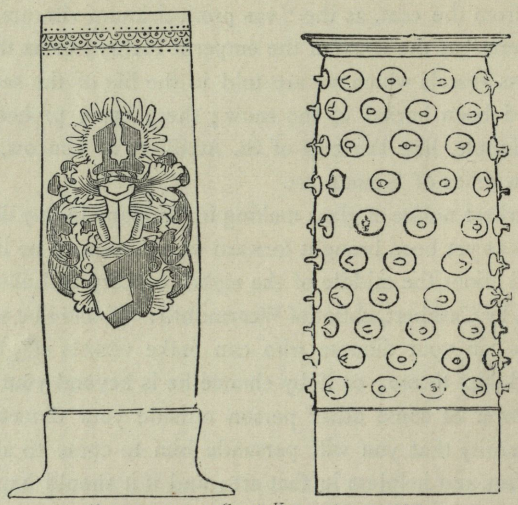
German, 1616. (1842-'55.)

have been continued in Germany, for they are spoken of in the metrical life of Eigilis (*ob.* 822), abbot of Fulda, written by his disciple Candidus. So St. Odilo, who lived in the beginning of the eleventh century, is mentioned (in his Life) as pouring wine into a little glass. All these were very possibly articles of home manufacture; others of more precious workmanship were either brought from the east, as the "vas pretiosisimum vitreum Alexandrini generis" at the court of the emperor Henry; or as the sculptured glass vessels which we are told in the life of the same saint Odilo had been buried in the snow; these came probably from Constantinople, like the cup of St. Adalbert at Cracow, or may have been relics of Roman art.

The earliest notice of glass making in Germany in any document which has as yet been brought forward would seem to be in a letter addressed about the middle of the eighth century to Lullo, bishop of Mainz, by Cuthbert, abbot of Wearmouth: "If there be any man" he writes "in your diocese who can make vessels of glass well, pray send him to me; or if by chance he is beyond your bounds, in the power of some other person outside your diocese, I beg your fraternity that you will persuade him to come to us, for we are ignorant and helpless in that art; and if it should happen that any one of the glass makers through your diligence is permitted (D.V.) to come to us, I will, while my life lasts, entertain him with benign kindness." Window glass was also made in Germany from a very early period.

Merlo (Künst and Künstler in Köln, p. 563) gives lists of artizans in Cologne, obtained from the ancient registers of that city; among these occur the names of Albertus and Otto at the dates 1160—1170, with the addition "ustor," and the author suggests that these may have been makers of glass. In 1335 is found one "Henricus factor vitrorum." The earliest instance of coloured windows which has been recorded appears to be that of windows given to the abbey of Tegernsee, in Bavaria, by a count Arnold in 999; but it is probable that nothing older than the twelfth century

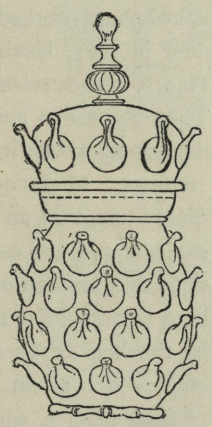
now exists. Obviously wherever window glass was made there was a possibility that vessels might be made; but little or nothing is known as to the progress of the art in Germany during the middle ages, and specimens are very rare. In the collection of porcelain &c. in the Japanese palace at Dresden is a green "Weinhahn" (a tap for a wine barrel?) in form of a stag, with the date 1420.



German glasses: South Kensington museum.

No considerable quantity of vessels undoubtedly of German origin is to be found which probably are of an earlier date than the sixteenth century. At that period the German glass makers produced a great number of vessels of distinct and peculiar character; the earliest of these are the cylindrical drinking-vessels, generally called wiederkoms, such as Nos. 469.—'73 *et seq.*, at South Kensington. These are sometimes very large, some being as much as 20 inches in height. The glass has generally a greenish cast, and they are ornamented with paintings in enamel of no great merit but with a stamp of originality. The designs most commonly met with are the emperor and electors of Germany, or the imperial eagle bearing on its wings the arms of the states which

composed the empire, or the arms of those for whom they were made. The oldest date which has been met with is that of 1553, on a specimen in the Künstkammer at Berlin; but the manufacture continued until about 1725 and a great many imitations are made in the present day. M. Max Misson, who began his travels through Holland, Germany, and Italy in 1687, gives a curious account of the arrangement of these German drinking-vessels at the time he travelled; he says, "You shall also know that glasses are as much respected in this country as wine is loved; they are paraded everywhere. Most of the rooms are wainscoted for about two-thirds of their height, and the glasses are arranged all round on the cornice of the wainscot, like the pipes of an organ. They begin by the little ones and end by the great, and these great are melon-glasses (cloches à melon), which one is obliged to empty without pausing when any health of special importance is to be drunk."



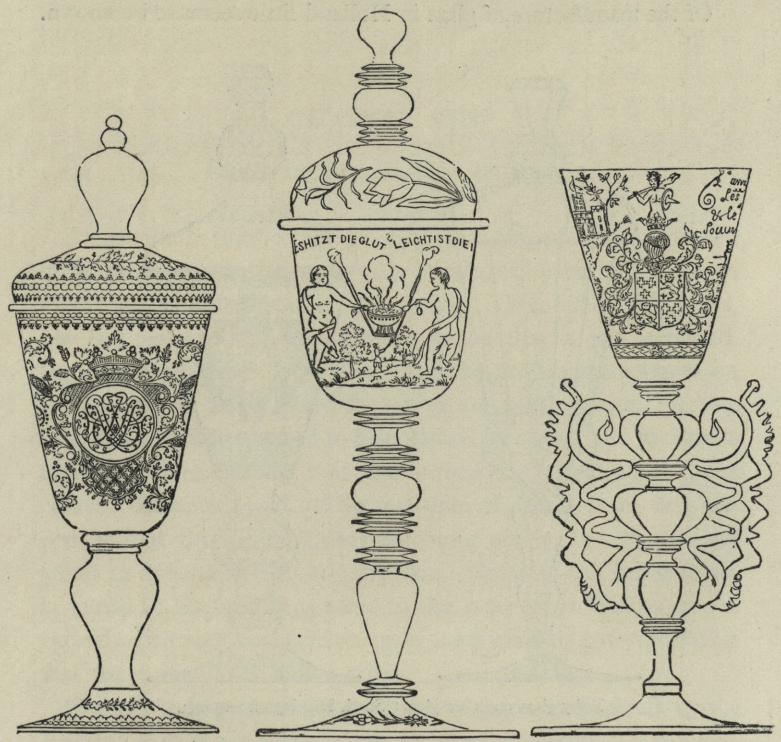
German, with raised bosses, dated 1643: South Kensington museum.

From the woodcuts which illustrate the chapter on glass making in the edition of George Agricola *de re metallica*, printed at Basle in 1561, we may gather some idea of the products of a German glass-house at that time; wiederkoms are to be seen ornamented like No. 243.—'72 in the South Kensington collection with small projections, bottles with big bellies and slender necks, and retorts. All the operations of a glass-house are represented in the woodcuts, and much information given as to the processes in use. The author does not suggest that any fine glass wares were then made in Germany, but refers to the furnaces of Murano as the sources of "opera multa praclara et admiranda." Towards the middle of the seventeenth century paintings of much greater artistic merit were executed on goblets and wiederkoms; these are most frequently painted in grisaille, and often represent processions, battles, or like subjects.

About the year 1600 glass was extensively made in Bohemia and other parts of Germany. From the beginning of the seventeenth century some of the Bohemian glass manufacturers had succeeded in producing very pure crystal glass, well adapted for engraving. Casper Lehmann who was in the service of the emperor Rudolph II. received from that sovereign, about 1609, the title of lapidary and glass-cutter to the court, and worked at Prague. He had there an assistant, Zecharias Belzer; and a scholar, George Schwanhard, who obtained from the emperor a continuation of Lehmann's patent. Schwanhard worked afterwards at Nuremburg and Ratisbon and died in 1667, leaving two sons; George, who died in 1676, and Henry, who survived him for a good many years, dying in 1696. These appear to have worked both with the lapidary's wheel, producing engravings in incavo, and with the diamond point, producing etchings. M. Jacquemart credits Johann Schapper with extraordinary talent as an engraver on glass, asserting that he produced subjects and arabesques of such delicacy of execution that at first sight they seemed merely like a cloud on the glass. Henry Schwanhard is believed to have discovered the method of etching on glass by the help of fluoric acid, about the year 1670. He generally employed it to eat away the ground, leaving the figures with their original surface, which, being smooth and clear, contrasted with the dull ground. Hermann Schwinger was also renowned as a glass engraver at Nuremburg; he was born in 1640 and died in 1683. One of his productions is in the Slade collection in the British museum, No. 883 in the catalogue.

Some of the engravings show very good drawing and much skill in execution. Dr. Pococke, who travelled in Germany in 1736, says that some of the large drinking-glasses made at Rispen, to which the Potsdam glass works had been removed, were so finely cut as to sell for from 100*l.* to 150*l.*, and that the glass was the best in the world. The Bohemian glass, he tells us, was thick and strong and almost as good as the English. It was ground into figures at Breslau, and he saw a glass the cutting of which cost 20*l.*

Such ornamentation became fashionable and popular, and the art was practised in Holland and probably also in France and in England.

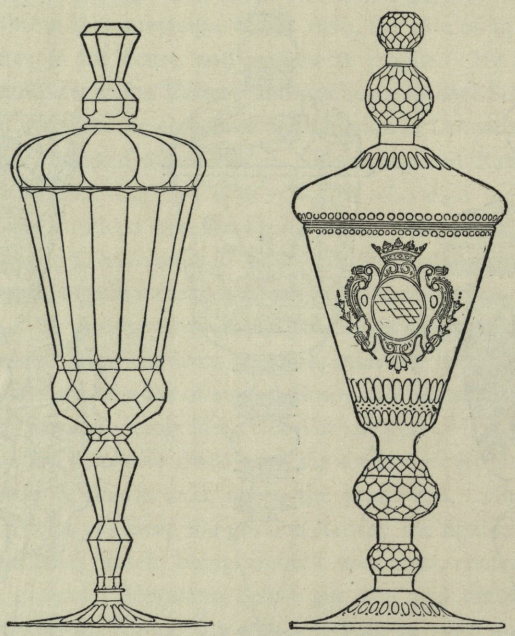


Vases, etc., German: South Kensington musuem.

One of the most remarkable productions of the German glass-houses is the beautiful ruby glass which, though it had been already produced both by Romans and Venetians, was brought to perfection by Kunckel, about 1679, when he was director of the glass-houses at Potsdam. It is believed that he obtained the finest colour from gold, though he affirmed that he could give glass a perfect ruby red without the use of that metal. It is now well known

that a beautiful ruby can be obtained by the use of copper, but the manipulation is difficult and the result somewhat uncertain, a little more or less exposure to heat producing very different tints.

Of the manufacture of glass in Holland little seems to be known.



Ruby glass and clear glass: South Kensington museum.

Dr. Christopher Merret who translated and annotated Neri's treatise on glass, in 1662, gives a description of the glass furnaces of the time; and in the Latin translation of his work, publisned at Amsterdam in 1668, we have an engraving of a Dutch furnace and the tools there employed. Etching on glass seems to have been practised with considerable success in Holland, as shown by specimens in the Slade collection; and also engraving on glass, though at a somewhat later date.

CHAPTER VIII.

Glass in the British Islands.

A passage in Strabo (lib. IV. c. 5), in which glass is mentioned in connection with the trade with Britain, has been held to mean that it was exported from it: the passage is somewhat ambiguous, but the real meaning would seem to be that it was imported. Some remarks which have been made by professor Buckman on the analysis of beads found in tumuli are worth notice. A blue bead found in Wilts proved to be coloured by copper and to contain no lead, whereas he says that Roman beads of "light bluish-green colour" contained lead. The real date of beads is so very uncertain that this perhaps does not prove much; but the subject seems to deserve further investigation. Some of the beads found in tombs in England (*e.g.*, some in the museum at Whitby) are of exceedingly rough and careless make, and it seems not improbable that these may be of native origin.

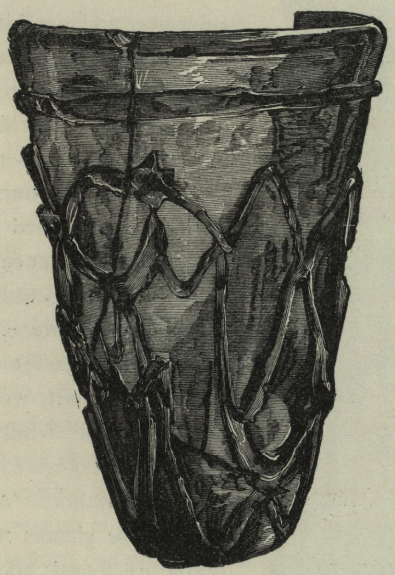
Though it is probable that glass was made in England by the Romans it does not seem as yet to be quite certain. Many fragments of ornamental glass have been found in England, particularly in London, and in the British museum is a very curious collection formed by Mr. Charles Roach Smith. They are, however, in most cases so precisely similar to those found in Rome as to lead to the supposition that they were imported. The glass vessels in tombs of the Roman period in England are usually greenish in hue, but blue vessels are not very uncommon. Window glass has been met with in considerable quantities in the ruins of villas and towns.

Probably only the commoner glass was made in the country, and the finer articles imported.

Some remains of a glass furnace were excavated in the year 1860 at Buckholt, near the Roman road from Winchester to Salisbury, which if they were of the Roman period would prove that coloured and ornamental glass was then fabricated in England. Mr. A. W. Raper wrote in the *Queenwood Observer* an account of them, from which the following is epitomized:—"The furnace was of brick, about nine feet in diameter, with four spurs of brick and flint, about ten feet long; the bricks were cubic lumps of clay, about one foot each way. Many pieces of pots were found half to one inch thick, glazed on both sides, one or two were fluted, one crossed with rude lines of a diamond pattern. Lumps of glass nearly as large as an egg, scores of drops of glass, and many pieces looking like the neck of a bottle split vertically, were found. Also two or three tops of vases like the mouth of a trumpet, with a peculiar hollow rim of the same kind, all of impure green glass; handles of various shapes, one of a very elegant, decidedly classical shape, and of a beautiful purple colour; many pieces of flat window glass, very impure; a kind of handle of green glass, with stripes of white glass incrusted therein longitudinally, the whole twisted like a cord; also pieces of green glass with ornamental white spots inlaid; also a piece of flat glass with a scarlet pattern, as it were, printed on it, something like a floorcloth pattern. Some of the glass was of a beautiful Prussian blue, some was purple, the greater part green, and a very few specimens were quite pure and white."

These remains were also the subject of a communication to the British archæological association in 1861, and Mr. Syer Cuming made some remarks upon the objects exhibited; among them were a fragment of undoubted Roman pottery and some fragments of pottery of the time of Elizabeth or James I., a piece of painted glass of the fourteenth century, the base of a tumbler-like cup of the seventeenth century, many pieces of window glass, not cast but blown, one fragment showing a thick border; and many fragments

of vessels which, in Mr. Cuming's opinion, were not older than mediæval times. The specimens exhibited are said to have been bright green with white spots on a yellowish-green surface, white stripes on a dark ground, and one piece "with circles and spots, the cross lines red on a black ground." Mr. Cuming's conclusion was that the fragments were "cullet" brought to be re-melted, and



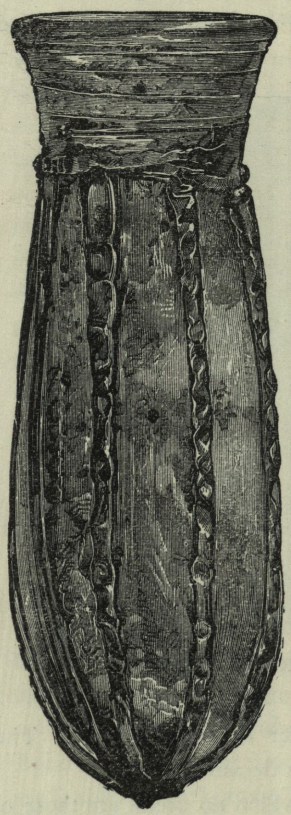
Anglo-Saxon drinking-cup: South Kensington museum.

that the furnace was probably not older than about 1550. The evidence seems scarcely to warrant any decisive opinion.

In graves in Kent and elsewhere, which no doubt are those of the Saxon inhabitants before or soon after their conversion to Christianity, many vessels of glass are found. As has been said before, very similar vessels are found both in France and in Germany; but Mr. Roach Smith thinks that a greater number and more varieties have been found in England, and this certainly

gives some ground for the reasonable supposition that they may have been made here.

Most of them are elongated tumblers and really deserve the name, as their bases are either rounded or terminate in such small feet that they cannot be made to stand. They are composed of glass without lead and of a horn-like appearance, and are blown very thin; occasionally they have a number of lobes attached to the exterior, giving them a very singular appearance; often they are ornamented with threads of glass wound round them, sometimes disposed spirally or in wavy lines, whence perhaps the expression in Beowulf (line 995), "hroden-ealo-wœge," twisted ale-cups; they are often of a pale straw colour. So many were found some years ago at Wodensborough, in Kent, that they were used in a neighbouring farmhouse as beer-glasses. With these glasses many strings of beads are found, good examples of which are in the Kensington collection. The patterns and colours are not unlike those found elsewhere and indeed often resemble those made at Murano at the present day, but they appear to be in general of remarkably coarse execution.



Anglo-Saxon drinking-cup: South Kensington museum.

If these glasses were really made in England the art of making glass for windows would seem to have been unknown, for about A.D. 675 when Benedict Biscop required workmen to make glass

for his monastery at Wearmouth, he procured them from France. Possibly the artizans then brought over understood the art of making glass and casting it in plates for windows, but not that of blowing it and forming vessels; for about eighty years later we hear of an abbot of Wearmouth (as we have said when speaking of glass in Germany) applying to the bishop of Mainz to have a maker of vessels sent to him. At what time the manufacture took root in England has yet to be ascertained.

Glass drinking-vessels were used by the Welsh as well as by the Saxons and are mentioned by the poets Llywarch Hen and Aneurin, both attributed to the sixth century. The Welsh name for glass, wydr or gwydr, is evidently derived from the Latin vitrum, and it is perhaps not improbable that some knowledge of its manufacture may have been retained by the Welsh after the departure of the Romans.

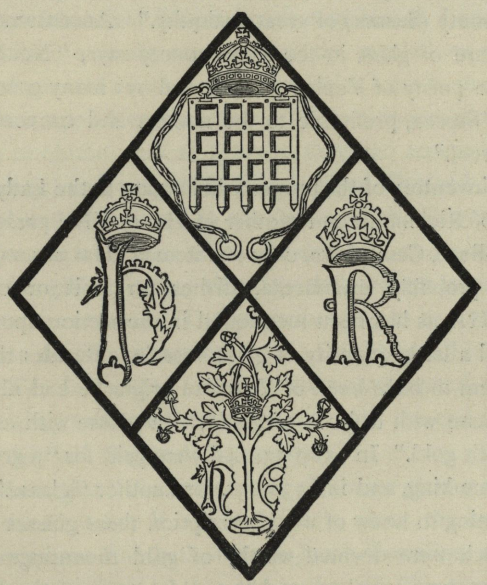
Mr. Hudson Turner asserts that there "is not a particle of evidence to prove that any description of glass was manufactured in this country before the fifteenth century;" but we find in the roll of the "taxacio facta in burgo Colcestrie" in 1295 among the jurors, Robert le Verrer, and in that of 1300, Matthew le Verrer; Robert le Verrer is taxed (among other goods) in the taxation of 1300, on "biletts pret. xviii. d. vitrum pret. iiii. s." Henry le Verrer is also taxed, but no mention is made of his stock-in-trade. These appear, from the enumeration of their property and their position as jurors, to have been among the chief inhabitants of the town, and they probably were not merely glaziers and glass painters but glass makers. If not the latter, it is difficult to understand why there should have been so many glaziers in such a town as Colchester, and those not petty but principal tradesmen. Possibly the sand of the adjacent coast is of a kind suitable for glass making; the salt marshes furnish abundance of those plants whose ashes yield the necessary alkalies, and potash could be obtained from fern; abundance of wood was in the vicinity. Colchester, therefore, was not at all an unlikely spot to have been selected as the seat of a manufactory of glass.

It is probable that during the middle ages glass was manufactured in England, as in most European countries, chiefly for use in windows. Sufficient skill to produce articles of such elegance as to fit them for the tables of the rich was probably wanting, and the somewhat rough habits of life then prevalent made vessels of wood, of leather, or of coarse pottery, more suitable to the poor.

Still, as has been shown, the idea of using glass bottles to hold drugs was familiar, and we find them employed to contain relics. In the kalendar of the treasury of exchequer in the eighteenth year of Edward III. mention is made of "a glass bottle in which is contained oil of saint Mary of Sardenaye;" and among the relics of the church of Durham was some of the blood of Saint Thomas the martyr in a glass bottle, and two lamps of glass, one called that of St. Lucia. In the Proceedings of the society of antiquaries for 1871 is engraved a phial of glass which appears to have contained a kind of oil, and was found in the lower part of the wall of the church of South Kilworth, Leicestershire, dating between 1390 and 1420. Another, very similar, was found in the wall of the church at Lutterworth, which is of about the same date; and recently a small bottle has been found in the wall of the church of Anstey, Herts, containing a fluid which, on analytical examination, appears to have been blood; it is of well made clear glass, much wasted and iridized. It is proper to add that doubt has been thrown upon the antiquity of some of the glasses so found in church walls.

Though the Venetian galleys brought vessels of glass to England such objects are but rarely mentioned in English mediæval domestic inventories, and when they do occur they are generally described as mounted in gold or silver. One exception is, however, in the kalendar of the treasury of the exchequer in the mention of "1 verre de glass," which is followed by another "verre de glass" painted outside, with a cover of silver gilt and pounced, valued at 6*s.* 8*d.*; this is in the first year of Henry IV. In the twelfth year of Edward III. we find in the same repository a "gourde" of glass supported on snails, but not valued (nient prise).

Of the English manufacture of glass at this period but little has been ascertained. In the church of Lingfield, Surrey, is an effigy of one of the Cobham family, circa 1380, in armour with the large belt in use at that period, the links of which were inlaid with pieces of blue glass; but during a "restoration" which took place some years ago these were abstracted. The earliest positive evidence that we have of the making of glass in England seems to be in 1447, when John Prudde of Westminster, in covenanting to execute



Window glass; English, about 1500.

the windows of the Beauchamp chapel at Warwick, engages to use no "glasse of England:" the covenant clearly shows that English glass was commonly made at that time, though not esteemed. In 1485 English glass is again mentioned in conjunction with "Dutch," "Venice," and "Normandy;" the price of the first was 1*d.* per quarrel, of the second 4½*d.*, of the third 5*d.*, and of the fourth 6*d.*

per foot; so that the English, if the quarrels were of an ordinary size, was the dearest and to be presumed the best.

We are told by Thomas Charnock in his *Breviary of Philosophy*, in 1557,—

> "As for glass makers, they be scant in the land,
> Yet one there is, as I do understand,
> And in Sussex is now his habitation,
> At Chiddingsfold he works of his occupation."

And Fuller, writing in 1662, asserts that "coarse glass making was in this county (Sussex) of great antiquity." Another notice of the manufacture of glass in the same county says, "Neither can we match the purity of Venice glasses, and yet many green ones are blown in Sussex, profitable to the makers and convenient to the users thereof."

In the inventory of the property belonging to the Lady Margaret, duchess of Richmond and mother of Henry VII., preserved at St. John's college, Cambridge, only one item of glass occurs, "glassery basons," probably ornamental dishes for fruit or confections. Henry VIII., as has been mentioned in the section upon Venetian glass, had a large quantity of glass vessels. Besides those which would seem to have been of Venetian origin he had also "a goblett of glasse with a foote of golde," "a glasse with a cover garnished with gold." In 1529 53*s.* 4*d.* were paid for "a great glasse" for the same king, and in 1530 45*s.* for another "glasse." It would be interesting to know of what description these glasses were, both those which were deemed worthy of gold mountings and those which cost sums equal to, perhaps, 20*l.* to 25*l.* of the currency of the present day. It is not very often that Venetian glasses are mounted, their thinness and delicacy making them rather unsuited for such decoration. From this time we begin to find much greater quantities of glass wares in inventories; as, for instance, in the inventory of the goods of Robert earl of Leicester at Kenilworth, in 1588: "Tenne glasse dishes gilte with the sinque-foyle on the brims, eight graven dishes of glasse aboute the brim, three dozen

and four dishe glasses, two glass ewers, and twelve beare glasses, three with covers."

This increasing use of glass led to the reflection that large sums of money were annually disbursed from England for glass from abroad, and to the question whether it might not be made at home; adventurers from Venice, or the Low Countries, or France, no doubt sought their fortune by bringing before the English government schemes for making glass of superior quality. The earliest positive evidence of such an attempt would appear to be the petition in 1550 from eight Muranese glass makers in London to the council of Ten; a result, no doubt, of the regulations which that council had enacted a little earlier, and which have been mentioned in the section upon Venetian glass. The petitioners state that not being able to obtain work at Murano, they had accepted no small sum of money to go to work in Flanders and England; that they were seized and imprisoned in the depths of the Tower, living on bread and water, and then taken out and kept under custody and penalty of the gibbet, in case they departed without having worked out the money received. They therefore beg to be excused from the penalties denounced against them. On the 13th June 1550 the council of Ten deliberated on this petition, and agreed, in order to gratify the king, to allow them to remain until the end of the term for which they had engaged themselves.

Stow tells us that "the first making of Venice glasses in England began at the Crotchet Friars, in London, about the beginning of the reign of queen Elizabeth, by one Jacob Vessaline, an Italian." It is to this manufacture that the author of *The present state of England*, anno 1683, alludes when he states that in 1557 glasses (not glass) first began to be made in England, and that the finer sort were made in Crutched Friars; and it may be that in this manufactory the Muranese were engaged.

Not very long after, in 1565, we find a letter from Armigill Wade, clerk of the council, to Sir Wm. Cecil, from which the following is an extract: "The man" (Cornelius de Lannoy) "no doubt ys at great

charges, he thought he might have had his provisyons in England as in other places; but that will not be. All our glasse makers can not facyon him one glasse tho' he stoode by them to teach them. So as he ys now forced to send to Andwarp and into Hassia for new provisyons of glasses, his old being spent. The potters cannot make him one pot to content him. They know not howe to seasson their stuff to make the same to susteyne the force of his great fyers. The Spanyard would make me believe that Cor [*i.e.*, de Lannoy] hath finished his bussynes already, the wich I suppose not to be true. Marry I do perceave he hath dyverse tymes occupyed his melting furnace, and alwayes in myne absence, he telleth me he hath made thessaye [*i.e.*, the trial] of certain ewres . . . . he hath the scope of three yeares for this respect. I would he wear putt in sume generall cumfort of some place to be provided for him here in England, he liketh marvelously well the syte of Guldeford." This letter is written from "Belsys," and in it is enclosed an account from which it appears that 150*l.* had been paid to De Lannoy for provisions and 30*l.* on his coming into England, and that he was to receive 30*l.* per quarter. He had not been very long at work as his first quarter's pension only fell due on 25th March 1565.

From the letter it would appear that the undertaking was rather the ornamentation than the making of glasses, and also that no successful result had been arrived at in the first six months. De Lannoy (or Launoy) was most likely from the Netherlands. The undertaking probably failed, for we hear no more of it. In 1567 Pierre Briet and Jean Currie (or Quarre) wrote to Cecil from Windsor, desiring permission to erect glass works similar to those of Venice. They had a recommendation from the Vidame of Chartres.

On the 9th August 1567 John Quarre and Anthony Becku, *alias* Dolin, "borne in the Low Country under the dominion of the king of Spayne," made a formal statement of the conditions under which they proposed to make "table glasse as is used here for glasing,

brought hither out of Burgundy, Lovayn, and France," and their conditions were agreed to. These include a prohibition against the making of such glass by others, the privilege to continue in force for twenty years. In 1568 the same persons petitioned for leave to cut wood and make charcoal in Windsor great park. They made a contract with Thomas and Balthazar de Hamezel, dwelling at the glass-houses of Vosges in the country of Lorraine, to come into England, make glass there, and teach the art. In 1589 George Longe petitioned for a new patent, and in his petition states that there were fifteen glass-houses in England; these he proposes to reduce to two, and to put up others in Ireland.

The manufacture must, however, during this century have reached a certain amount of importance, because, as we have before mentioned, Richard Hakluyt included in the list of articles which he proposed to be carried with the expedition for the discovery of Cathay eastward in 1580, besides Venice glasses, "glasses of English making." In 1574 the bishop of Chichester writes to Lord Burghley that "of very late, aboute Petworth, certayne had conference to robbe the Frenche men that make glasse, and to burne there houses, but they be apprehended and punished." In 1595 mention is made of one Adrien, an Italian, who had been for five years a glass maker in England, in a letter from an anonymous Jesuit, disclosing a scheme to fire the navy by "artificial fire-balls, the size of a fist, that will fire even though in water." The glass maker was probably brought into the scheme in order that he might furnish the vessels in which, as with the Saracens in the twelfth century, the mixture was to be contained.

Before 1611 Sir Wm. Slingsby had obtained a patent for making glass with sea coal; and in 1615 a royal proclamation was issued prohibiting the use of wood in glass making, and ordering it to be made with sea coal or pit coal only; the importation of foreign glass being at the same time prohibited. In 1620 permission was granted to the patentees to import rare and curious glasses. Sir Jerome Bowes and Sir E. Zouch obtained patents for glass making,

but after much negotiation Sir Robert Mansel acquired, about 1616, the exclusive property in the patents, and set actively to work. Many disputes ensued respecting the quality and price of Sir R. Mansel's glass; from the statements made by complainants and others it appears that he made both window glass and glass vessels of various kinds.

Some one of these glass-houses was probably that which Strype mentions in these words: "Here" (*i.e.*, in Broad Street Ward) "was a glass-house where Venice glasses were made and Venetians employed in the work, and Mr. James Howel, in James I.'s time, was steward to this house." At the archæological association in 1874 several objects were exhibited said to have been found recently on the site of this glass-house, afterwards that of Pinner's Hall in Broad Street. They were described as a tall wine-glass on ornamental foot; a square scent-bottle, a ribbed fountain ink-stand, a stem of white filigree, a flower-vase on a serpent stem, emerald glass for beads, an "engraved specimen of vitro d'oro," a large calendering rubber of blue glass, and a wine-glass with curved lip and an air-bubble in the stem.

About 1620 an attempt was made to set up glass works in Scotland, and John Maria dell' acqua, who was sent for from Venice and worked for Mansel for two years, had the post of master of the works in Scotland offered to him. In 1623 Sir R. Mansel states that he had erected furnaces in London, the isle of Purbeck, Milford haven, and on the Trent, all of which had failed, but that he had established them successfully at Newcastle-on-Tyne, at which place perhaps glass making was already practised, for in 1570 Bertram Anderson, alderman of the town, had ten dozen drinking-glasses. In 1577 Thomas Liddell, also of Newcastle, sold "flacketts" (small bottles?) of stone and glass. In 1624 Mansel's patent was exempted from the operation of the act of parliament of that year against monopolies. If he endeavoured to make glass which would compete with the drinking-glasses of Venice he does not seem to have succeeded, for they were still

imported; as we learn from a letter of Sir Isaac Wake in 1625, with note of chests of glass sent from Venice to the duchess of Buckingham and others. In 1635 a proclamation was issued setting forth that divers ill-affected persons continue to import glass, and renewing the prohibition against the so doing.

In 1634 Sir R. Mansel again addressed a statement to the council in which he says that he was out of pocket 30,000*l.* before the manufacture could be perfected, and that in his absence at Algiers his patent was declared void by the house of commons. That the late king had granted him a patent for fifteen years but his workmen were drawn into Scotland, so that most of the glass used here was imported from thence, and he was obliged to buy up the Scotch patent at 250*l.* per annum. That after his men returned from Scotland they made such "ill-conditioned" glass that he was forced to procure a whole company from Mantua. That then his clerk ran away to France, and by his procurement the greater part of the drinking-glasses sent here was brought from thence. That this import was stopped by the order of council in 1632, since when he had been at great charge in perfecting the work of looking-glass and spectacle plate-glass plates; and that he had not raised, but on the contrary had lowered, his prices. He further states that his men had now again withdrawn to Scotland and that glass is attempted to be made in Ireland. From about this date until after the Restoration nothing concerning Mansel's glass manufacture is to be found in the state papers; but in 1660 several persons endeavoured to obtain a renewal of his patent—Philip Howard (son of the earl of Berkshire), Sir C. Berkeley, Arundel, widow of John Penruddock, and others; but it would seem that it was not revived.

A most important change in the practice of glass making was introduced in England at some period during this century, viz., that of using large quantities of lead (with a proportion of potash) as a base; the glass so made is known to us as flint-glass, to the French as "cristal." The use of lead in glass making was not

exactly a discovery, for clear glass of the Roman period containing lead has been sometimes, though rarely, met with; and, according to Klaproth's analysis (*see above*, p. 23) the opaque red glass, called "hæmatinum," contains a good deal of lead. As has been said before, glass containing lead was known in the middle ages as Jewish glass. Heraclius gives a recipe for making such glass; but in it is no mention of potash, and the product would therefore be not flint-glass but a silicate of lead, a very fragile substance though susceptible of being moulded or blown. An oval mass of green transparent glass, measuring 14 inches by 12 inches, was preserved in the treasury of St. Denis under the name of the "mirror of Virgil." This when analysed in 1789 proved to contain about half its weight in oxide of lead, but whether it contained potash does not appear. It was probably of Byzantine origin, like the emerald at Reichenau.

M. Peligot, after reviewing these facts, comes to the conclusion that there is no proof that the true flint-glass was known to the ancients, and that "to the English should really be attributed the honour of having created in their flint-glass a new product, which by the progress made in the quality and selection of the materials used in its fabrication has become, without dispute, the most beautiful glassy substance which we know, and which it may be possible to produce."

To whom it first occurred to use this compound on a large scale and the precise period at which its use was introduced have not been ascertained. Merret, writing about 1665, says that glass made with lead was not manufactured in the English glass-houses, on account of its too great fragility, a notice which proves both that it was known and that its composition or management was not thoroughly well understood; but very soon after, viz. in 1673, as will be seen below, lead was in full use at Lambeth, and produced glass "as clear, ponderous, and thick as crystal." M. Bontemps argues with much force that flint-glass was probably first made after about 1635 (? 1615, *see* p. 127), when coal was used for

fuel instead of wood. The use of coal makes it necessary to employ pots closed at the top. The material to be fused is thus in some degree protected from the heat, and it becomes desirable to augment the proportion of the more fusible element, viz. the alkali; but this could not be done without injury to the colour and quality of the glass, and oxide of lead was therefore added and the quantity of alkali diminished. It seems not improbable that Sir R. Mansel's success in the manufacture of glass, at Newcastle-on-Tyne before 1623, was due to the new system of manufacture.

Glass works in which the duke of Buckingham was interested were carried on in London. Evelyn in 1677 says, "We also saw the duke of Buckingham's glass work, where they made huge vases of metal as clear, ponderous, and thick as crystal; also looking-glasses far larger and better than any that come from Venice." This glass-house would seem to have been at Lambeth, as the author of *The present state of England*, anno 1683, says that flint-glass plates for looking-glasses and coach windows were made about 1673 at Lambeth, by the encouragement of the duke of Buckingham. Glass, probably for vessels, was also made at Greenwich; for in Evelyn's diary (1673) is the following passage: "Thence to the Italian glass-houses at Greenwich, where glass was blown of finer metal than that of Murano, at Venice." From the Lambeth glass-house came, no doubt, many of the mirrors with bevelled edges still remaining in old houses. Probably some of the drinking-glasses then made also remain, such as the "flint-glass a yard long" in which, as Evelyn records, James II.'s health was drunk at Bromley in 1685.

The revocation of the edict of Nantes in 1685 drove a great number of artizans from France, and among them several workers in glass; a great impulse was thus given to the manufacture, and in 1736, as we have seen, the English glass was considered by Dr. Pococke to be superior to that of Bohemia, and only inferior to that made in the Prussian glass-houses under royal patronage and with unlimited outlay. All that was produced was not of equally

good quality, for a French writer in the year 1760, M. Bosc d'Antic, criticises the English flint-glass of that period in the following terms: "Their 'cristal' is not of a good colour, it is rather yellow or brown, if the red colour of the manganese a little preponderates. It is so ill melted that the salt breaks out, it gets dirty, readily corrodes, and is full of spots and clouds."

In more recent times a manufactory of glass at Bristol acquired a certain reputation, but its products (for example Nos. 911 to 913 at South Kensington) are chiefly of a later date than the limit which has been fixed for this essay.

Some knowledge of the art of glass-working seems to have existed in Ireland from an early period; for small pieces of mosaic glass (as in the cross of Cong and the Lismore crozier) and cameo heads (as in the Tara brooch) are found in work of Irish origin. The specimens of mosaic glass display remarkable skill, as may be seen in the crozier of Lismore (belonging to the duke of Devonshire), which was made for a bishop of that see who died in 1112, but it is of course possible that the glass ornaments may be of an earlier date. Another process of decoration employed was that of cutting into the surface of a piece of glass, or more probably of impressing a pattern on the glass while soft, and filling the cavity with metal or glass or enamel of another colour. Beautiful examples of this may be seen on the chalice dating from the ninth or tenth century, found some years ago at Ardagh in the county of Limerick, now in the museum of the royal Irish academy.

The colours and patterns used in these processes are so peculiar as to render it highly improbable that the objects referred to were made elsewhere than in Ireland. It is a very interesting question whence this art was derived: there is no indication that it was practised at the time either in England, France, or Germany; apparently, therefore, it must have been learnt at a very early date either from Rome or from Constantinople, or even possibly from Egypt. This last origin may appear at first sight very doubtful, but it has been observed by Dr. Keller in his remarks on the Irish

manuscripts at St. Gall, that the style of ornament and colouring which characterizes them has much analogy with Egyptian art; and he points out that there is direct evidence of the sojourn of Egyptian monks in Ireland in the mention in the "Leabhar Breac" of seven Egyptian monks who were buried at Disert-Ulidh.

Many glass beads have been found in Ireland; some are identical, or almost so, with those found elsewhere, but some are peculiar, particularly those the ornamentation of which is composed chiefly of a twist of clear and white opaque glass. Vessels of glass were also in use in Ireland at a very early time. In the "Tripartite life of St. Patrick" (seventh or eighth century?) mention is made of "a certain stone cave of wonderful workmanship, with an altar underground, having on its four corners four chalices of glass," at Duma-Graidh in the county of Sligo.

CHAPTER IX.

Glass in China.

Various assertions have been made as to the antiquity of glass making in China. If the conjecture that when Pliny mentions Indian glass as the best in the world the product in question was in reality Chinese be well founded, the fabrication of glass in China began at a very remote period. There is no improbability that such was the case, because there was some intercourse both by land and by sea between China and its western neighbours, although it may not have been very active, and some knowledge of the art may have found its way thither; or it may even have been independently discovered by that ingenious people, who in so many arts have shown great power of invention. Their pottery would seem to have been glazed from a very early period, and they have long practised the art of enamelling on metal: both these are arts near akin to that of glass making. An argument in favour of its having been really of indigenous invention may be derived from the peculiarity of the objects produced, which, until very recent times, appear to have been not clear glass for windows or for domestic utensils, but objects coloured in imitation of natural stones, and cut like them into somewhat massive forms.

The native writers, at any rate, assert the existence of glass making among them at a period anterior to the Christian era.

According to one of the French missionaries at Pekin who wrote about 1770, the emperor Ou-ti, one of the Han dynasty

which occupied the throne about 140 B.C., had a manufactory of lieou-li, a species of glass, perhaps made with alkali derived from fern which bears the name of lieou-li-tsao, *i.e.* the lieou-li herb. He also states that the ancient dictionary Eulph-ya speaks of lieou-li, that the Tsi-yo says that false pearls were made from it, and that a very ancient commentary on the Hiao-king asserts that mirrors were made of glass coated with some composition. We also learn from the same writer that the words po-li were in use for glass at a very early time; and he quotes from the Chinese annals that in the beginning of the third century the king of Ta-tsin sent to Tai-tsou, of the Wei dynasty, very considerable presents of glasses of all colours, and some years afterwards a glass maker, who by means of fire could change pebbles into crystal and who taught the art to disciples.

The Wei dynasty reigned in northern China, and the manufacture of glass in Shan-tung, extensively practised at the present day, perhaps owes its origin to the glass maker of the third century. The missionary goes on to say that he could furnish many other proofs of the antiquity of the art in China; but he confines himself to the mention of a vase of glass presented to the emperor Tai-tsou (A.D. 627), which was so large that a mule could have been put into it, and was brought to the palace in a net suspended between four carriages. The manufacture of glass was, however, he thinks, never carried on extensively—the writers who mention it speaking with a kind of contemptuous pity of the false pearls, the mirrors, the celestial globes, the windows, screens, and great vases made under the Han dynasty. The ancient books, he says, stated that mirrors were made from pebbles and a material obtained from the sea and reduced to ashes,—an evident allusion to soda prepared from seaweed.

Glass making, therefore, having been in China a manufacture not generally diffused over the country but carried on in a few localities, it cannot be expected that, with our small acquaintance with the literature of the country, much should have been ascer-

tained as to its history from the native writers. One allusion to glass, which proves that it was known to the Chinese in the fourteenth century, may be mentioned; it is from a Chinese writer of about the year 1350, and occurs in an account of Ceylon: "In front of the image of Buddha is a sacred bowl, which is made neither of jade nor copper nor iron; it is of a purple colour and glossy, and when struck it sounds like glass." This vessel was the famous patra or alms-pot of Buddha.

Considering how little communication took place between China and Europe until the sixteenth and seventeenth centuries, it is not surprising that with one exception very little is to be learnt from any European writer on the subject of Chinese glass. In the geography of El Edrisi, written in Sicily in the year 1154, the following passage occurs in the chapter relating to China: "Djan-kou . . . is a celebrated city . . . the Chinese glass is made there." Djan-kou has not been satisfactorily identified with any existing Chinese city. M. Labarte expresses an opinion that porcelain, not glass, was really what was made at Djan-kou; but this seems to have been formed rather rashly: the words meaning glass and porcelain differ widely, both in Chinese and in Arabic, and neither El Edrisi nor his informants would have been likely to have made any confusion between the two substances, both of which must have been well known to them.

At the end of the sixteenth century we get a little light upon the state of the glass making in China. Father Ricci, a Jesuit missionary who was in China about 1590—1600, narrates (Purchas' Pilgrimes, vol. iii.) that he gave a prism of glass to a native convert, one Chuitaso, who put it into a silver case with gold chains, and "adorned it further with a writing that it was a fragment of that matter whereof the heavens consist. One was said to offer him five hundred pieces of gold soon after for it, which, till father Matthew had presented his to the king, he would not sell; after that he set a higher price, and sold it." From this we may infer that brilliant colourless glass was unknown to the Chinese, and

in another passage Ricci states that the Chinese make glass "but therein are short of the Europeans."

Père Duhalde, in his description or history of China first published in 1735, says that the kind of glass called lieou-li was made at Yen-tching near Tsi-nou-fou the chief city of Shan-tung. He states that it was more brittle than that of Europe, and broke when exposed to the inclemencies of the air (English edition, vol. i. p. 220). This account is curiously different from that given about forty years later. About the year 1770 we have more detailed accounts of the then state of Chinese glass making.

The French missionary already quoted says that the emperors of the reigning dynasty paid so little attention to the manufacture that they had not thought it worth while to place learners with the European glass makers who had been sent out, or even to have them brought from Canton. He further informs us that in his time there was a glass-house at Pekin where every year a good number of vases were made, some requiring great labour because nothing was blown; but he adds that the manufactory was only an appendage to the imperial magnificence, and so regarded. He concludes the subject with the reflection that the Chinese would be better clothed, lodged, and fed if glass were more common in China,—a remark which, though true as regards lodging, does not seem equally so as regards either clothing or feeding. The same writer gives a curious account of the lieou-li as made in his time: it was, he says, so thin as to be elastic, and all sorts of toys for children were made of it, also trumpets and grapes, which last were so like natural grapes as to deceive the eyes; these objects were extremely cheap. This statement, that glass was made so thin as to be elastic, may seem so remote from probability as to throw a doubt on its correctness, and to lead to the supposition that the writer confounded glass with some other substance. It is (on the contrary) sufficient to read his observations to be convinced that he was fully aware of the character and composition of glass, and very unlikely to have made any such mistake. Possibly the Chinese may have

a knowledge of some process by which the elasticity of glass can be very greatly increased.

In another French memoir, written in 1774, on the articles which might be imported with advantage into China, vessels of glass are mentioned, but with the proviso that they should be coloured and wrought (travaillés). Little bottles for holding snuff are spoken of as being made in China, and the French glass makers are advised to imitate Chinese forms if they desired to find a good sale for their wares.

Very little has been told by modern travellers as to the manufacture of glass in China; but the Rev. A. Williamson gives the following interesting account of it in the province of Shan-tung: "Long ago it was discovered that the rocks in the neighbourhood of Po-shan-hien, when pulverized and fused with the nitrate of potass, formed glass, and for many years the natives have applied themselves to its manufacture; I found them making excellent window-glass, blowing bottles of various sizes, moulding cups of every description, and making lanterns, beads, and ornaments in endless variety. They also run it into rods about 30 inches long, which they tie up in bundles and export to all parts of the country. The rods of pig-glass cost 100 cash per catty at the manufactory. The glass is extremely pure, they colour it most beautifully, and have obtained considerable dexterity in manipulation; many of the articles are finely finished." Po-shan is situated at the foot of a range of mountains, and the "rocks" which Mr. Williamson mentions are probably quartz: other parts of the province, as the neighbourhoods of Yung-ching and Tsi-ni, yield abundance of rock crystal of various colours.

It appears clearly that, at any rate up to the end of the last century, the manufacture of glass in China was not conducted in order to produce articles of general utility but rather to gratify that taste for rarities which is so strong among the Chinese. The case was the converse of that of the Romans: these last had no fine pottery, and therefore employed glass as the material for vessels

of an ornamental kind for table service and like purposes; the Chinese on the contrary, having from an early period had excellent porcelain, have been careless about the manufacture of glass.

Chinese glass, South Kensington museum.

Examples of Chinese glass of an early date—if they ever reached Europe—have never as yet been identified as such; but one would appear to exist in Japan. The following account of it is extracted from the *Athenæum* of the 7th August 1875. "We extract the following from a letter, dated at Yokohama, 25th of May: 'At Nara, an old capital of the Mikados, where seven of the descendants of the sun reigned in the eighth century, is an immense wooden barn, built by one of the kings, and where he placed all the treasures of his palace previous to the removal of the government to Kiyoto, where it has been ever since. This barn has been carefully repaired every sixty or sixty-one years, and is now entire and sound. The treasures have been from time to time inspected, and some additions have been made to those which are found in the original catalogue. I observed an ewer of white glass, about a foot high, which looked more modern than the eighth century. We were assured, however, by an antiquary who is engaged in describing the collection, that this ewer is one of the objects entered in the original list or catalogue which was deposited from the first.'" The same object, it would seem, is somewhat differently described

by a writer in the *Pall Mall Gazette* of the 7th of August 1875; he writes of it as "a handsome glass vase with a coloured glass cover." No one has as yet noticed the existence of any glass making in Japan, and it is obviously more probable that this vase was a present from China than an object of indigenous manufacture, if it be really of the period to which it is assigned.

Important specimens of more modern date are not common in Europe; vases of a semi-opaque yellow glass are perhaps those most frequently seen, and some fine examples were in the international exhibition of 1867 in Paris. One of these bearing the name of the emperor Kien-lung, 1736 to 1796, is in the South Kensington collection, No. 653.—'69. Vases nearly two feet high have been noticed in China, and one seen at Pekin had the imitation of a crack and rivets all executed in the glass. The glass objects from China which are more common in this country are small bottles to contain snuff; they are sometimes blue or red, with a coating of white, carved into landscapes or figures, and are often imitations of chalcedony, agate, and other stones; these imitations are executed with considerable skill and success.

Chinese glass deserves attentive examination, particularly from those who are interested in the manufacture of glass, for the colours are in many instances singularly fine and harmonious, and a good collection would probably be of great use in an industrial point of view.

INDEX.

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